THE EFFECTS OF SOCIAL AND TOKEN REINFORCEMENT SCHEDULES ON ORAL READING RESPONSES

BY

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THE EFFECTS OF SOCIAL AND TOKEN REINFORCEMENT SCHEDULES ON ORAL READING RESPONSES

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This study investigated the effects of social reinforcement and token reinforcment schedules on oral reading behaviors. Six boys and one girl enrolled in the third grade were selected by their teachers for the tutoring program because they were problem readers. The basic data were daily rates of correct and error flashcard and oral reading responses. The study was divided into four experiments, each comprised of two experimental conditions. The basic question being asked is whether there are predictable relationships between the schedules of token and social reinforcement and the rates of reading responses for the subjects. Results were predicted to be consistent with the reinforcement schedule research of Ferster and Skinner 1957, Long, Hammack, May and Campbell 1958, and Staats, Finley, Minke and Wolf 1964.

Social and token reinforcements were delivered by tutors on specified reinforcement schedules as the reading responses were occurring. Generally, two tutors worked with a child but on separate alternate days. Each tutor was associated with a different experimental condition.

Experiments I and II compared the effects of intermittent reinforcement schedules and the effects of two magnitudes of social reinforcers. In Experiment I, a condition of no-social reinforcement, i.e., extinction schedule, was compared with a VR schedule of social reinforcement. In Experiment II, three different schedule comparisons were made: 1) between an FI 30 sec and FI 300 sec schedule of social reinforcement; 2) between an FI 90 sec and an FR 6 schedule of token reinforcements; and 3) between a VR 3 schedule of "high intensity" social reinforcement and an FI 90 sec schedule of social reinforcement.

Experiments III and IV employed intermittent schedules to compare the effects of social comments delivered after correct or error responses. In Experiment III, the social reinforcers were delivered after correct responses on one schedule and on the alternate schedule, social reinforcers or social disapproval were delivered after error responses. In Experiment IV, a Tandem Brief-Stimulus schedule reinforced a specific sequence of error and correct responses. The alternate schedule only reinforced correct responses. The effects of the reinforcers were determined by analyzing the occurrences of the sequences of responses as well as the rates of the individual responses.

Additional data were collected on the social behaviors of the children and the patterns of academic responses. The patterns of flash-card responding were analyzed with cumulative records for one child and with sequences of correct and error responses for three children.

The results showed that when social reinforcement for correct responses was compared with social reinforcement or disapproval of error responses, the rate of correct responses was greater. When social reinforcements were delivered on two different intermittent reinforcement schedules for correct responses, there was no difference in the rates of correct responses. This result is similar to that reported by Staats, Finley, Minke and Wolf 1964, for token reinforcements on intermittent schedules. Episodes of social/emotional behaviors were related to the reinforcement contingencies. The pattern data showed that highly reliable patterns of responding developed for some of the reinforcement contingencies. These patterns were similar to those reported by Ferster and Skinner 1957.

CHAPTER I
INTRODUCTION

This study examines the effects of social reinforcement schedules on the reading behaviors of children. It is based on the 1957 experiments on pigeons and rats by Ferster and Skinner that resulted in the book, "Schedules of Reinforcement." The study is also based on experiments performed on human subjects by Long, Hammack, May, and Campbell (1958) and Staats, Finley, Minke and Wolf (1964). The results of the current study indicate that social reinforcement influences the reading behaviors of human subjects. However, the results do not clearly replicate findings on reinforcement schedules with non-human subjects.

A large body of animal research has studied the behavioral effects of reinforcement schedules. This research has shown that consistent patterns of behaviors develop on specific schedules (Ferster and Skinner, 1957), that a change in one behavior is associated with contrasting changes in other behaviors, (Reynolds, 1961), that intraspecies aggressive behaviors are induced by some appetitive reinforcement schedules, (Webbe, DeWeese, and Malagodi, 1974), and that the behavioral effects of drugs depend on the ongoing patterns of behaviors and the schedules in effect, (Herrnstein and Morse, 1956).

To analyze the effects of the reinforcement schedules, Ferster and Skinner used cumulative records which recorded each of the selected behaviors as they occurred moment-to-moment. Researchers have used this technique to analyze specific contingencies for the moment-to-moment interactions between the behaviors and the environment.

The findings of animal behavioral research have been important yet few studies have analyzed how these reinforcement effects can be generalized to human behavior. Human behavioral research has investigated the effects of various reinforcers on a wide variety of behaviors but it has paid little attention to the effects of the reinforcement schedules themselves. Human behavioral research has also led to a behavioral technology that has solved many behavior problems, (Baer, Wolf and Risley, 1968). However, the methods for investigating the effects of the schedules on human behaviors have not been established.

Studies investigating the effects of reinforcement schedules on human behavior have had problems replicating the results of the animal research. Long, Hammack, May and Campbell (1958), using a lever-pull response experiment, replicated with children some of the behavioral patterns that Ferster and Skinner demonstrated. Yet, the behavior patterns of the children directly attributable to the schedules were not consistent and were not enduring. Staats, Finley, Minke, and Wolf (1964) investigated the effects of reinforcement schedules on reading responses with children. The children had different rates of responding for the different schedules but once again, differential patterns of responding did not develop.

Purpose and Design of Study

This study examines the effects of specific reinforcement schedules on moment-to-moment reading behaviors of children. The purpose is to show that basic relationships exist between the reading behaviors of the children and the social comments and tokens delivered by the tutors. The rates of the correct and error reading responses are the basic data for the study. Special recording techniques were used with some children to provide data for analyzing the patterns of their responding. Social behaviors of the children were observed and recorded to determine some of the broad effects of the reinforcement schedules on the behaviors of the children.

In general, two tutors worked with the same child but on alternate days. Each tutor was associated with a different reinforcement schedule. This schedule can be defined as a multiple schedule with a 24-hour changeover between tutor and schedule components.

CHAPTER II
LITERATURE REVIEW

The purpose of this research program is to demonstrate the effects of the social reinforcers and the reinforcement schedules on the reading behaviors of children. There are just a few studies that relate directly to the purpose of this research but several studies are reviewed in the areas of social reinforcement, reinforcement schedules, and academic behaviors.

Since the research for this study was conducted in an elementary school, it first assured that the child was provided with the opportunity to learn to read. An attempt to improve a child's learning and performance must consider the task that the child is to learn, the child's ability to learn, and the child's motivation to learn. All three of these concerns are especially poignant for the child who is learning to read.

The reading task can be presented as a phonetic/sound system, or the child can be taught whole words by associations and memory, or these systems can be used in conjunction (Durkin, 1971). These approaches can be incorporated in a structured program (Parker and Scannel, 1963) or used in relation to the individual experience of the child (Stauffer 1970).

The ability of the child to learn to read has been discussed with regard to the child's maturational readiness to read (Ilg, Ames, and Apell, 1965), perceptual and integrative abilities (Satz and Friel, 1974), and background of related experiences (Engelmann and Engelmann, 1966).

In her interpretation of the ideas of John Dewey and Edmund Best, Durkin (1971) emphasized the interrelationships between the child's readiness to read and the methods used for the instruction of reading. For the child with a perceptual or integrative learning disability, the diagnostic/prescriptive model relates the teaching materials and methods to the specific needs of the child (Cawley, 1974). The systems of performance-based instruction and precision teaching adapt the teaching methods and strategies to the daily charted performance of the child (Gray, Baker, and Stancyk, 1969, Pennypacker, Koenig & Lindsley, 1972).

The child's motivation or intention to learn has been discussed psychodynamically (Holt, 1964), behaviorally (Skinner, 1968), and developmentally with regard to intrinsic motivation (Hunt, 1964). Each of these approaches integrate into their motivational systems considerations of the task the child is to learn and the child's ability to learn.

The following review is presented in three sections. The first section presents studies that have developed theories about the nature of social reinforcement. In the second section, studies are presented that have examined reinforcement schedules in human research. The third section looks at the effects of reinforcement on reading and academic behaviors.

Theories of Social Reinforcement

Social comments have been accepted as important reinforcers for human behaviors (Dickinson and Truax, 1966), (Greenspoon, 1962). Social reinforcement has been effective in controlling classroom behaviors, (Madsen, Becker, and Thomas, 1968), and in developing peer play behavior, (Allen, Hart, Buell, Harris, and Wolf, 1964).

This section describes three areas that researchers have examined in developing theories of social reinforcement:

1. Subject Characteristics and Social Reinforcement Effects
2. Information Function of Social Reinforcement
3. Drive Reduction Theory

Subject Characteristics and Social Reinforcement Effects

Zigler and Kanzer (1962) raised the question of whether all positive social reinforcements were equivalent as to the magnitude of their effects for all kinds of children. They discussed important dimensions for analyzing their question: types of previous social reinforcements used with the child; satiation and deprivation level for social reinforcement; long term deprivation of the reinforcement; anxiety level of the child; gender relations between the child and the reinforcing agent; the chronological or mental age of the child; and histories with tangible and verbal reinforcement. They strongly urged that these dimensions should be considered in relation to each child being reinforced. However, rather than study reinforcement in individual children, they proposed and then showed that comments of the correctness of a response were more effective for middle class children and comments of praise were more effective for lower class children with a marble dropping game.

There are many aspects of a child's history and makeup that may influence the effectiveness of a social reinforcement. Becker (1960) reported that teachers liked and better managed children who were more responsive to parental reinforcement than to peer reinforcements. Cairns (1961) trained children to be more dependent and found that this group was more responsive for social reinforcement than a control group.

In Hines (1973), first-born children performed more than later born children for social reinforcement. Greater social dependence was inferred for the first-borns. Fischer, Herschberger, Winer, (1971), found that individuals from small families responded more for verbal reinforcement than those from large families.

Information Function of Social Reinforcement

Several investigators have compared the affective reinforcing function with the information function of social reinforcement. The studies investigated three comparisons: (1) the condition of giving a social comment after a correct response and no comment after an error response, (2) the condition of no comment after a correct response and a social comment after an error response, and (3) different social comments after both correct and error responses. These conditions are noted respectively as, Reward-blank, Punishment-blank, and Reward-Punishment.

Within the basic paradigms Spence and Segner (1967) made an additional comparison between social comments, and candy and mechanical tone feedback for correct and error responses. They found that five of the six experimental groups were similar in performance, but the sixth group, the Candy-blank group was inferior to the rest. In a replication with younger children, Spence and Dunton (1967) found that both the Candy-blank group and the Reward-blank group were inferior to both Punishment-blank groups and both Reward-Punishment groups. The inferior performance of the Reward-blank groups was discussed in relation to the confusion of what a blank, i.e., no feedback means after a response. It was reported that adults and others often interpret a blank after a response as meaning that the response was correct.

Stevenson (1965) compared the reinforcement effects of social praise and critical comments. He found that young children worked the longest for social praise and gave up quickly with critical comments. However, twelve year old children did the most in response to critical comments. The evaluative meanings of different words have been shown to have differential reinforcement and punishment functions (Etaugh, Kelleher, and Stalling, 1970: Hafner, 1973).

Drive-Reduction Theory

Drive reduction has been used as a basic conceptualization for explaining the effectiveness of the primary reinforcers of an organism. This theory points out that organisms have several basic needs. When a need is fulfilled the organism is said to be satiated for that need. When an organism has gone for some time without a need being fulfilled, then, at that time, the organism is said to be deprived for the need. When a need has been deprived, the organism has a drive to fulfill that need. The reduction of the drive is the basis for the reinforcement process.

Gewirtz and Baer (1958b) showed that the effectiveness of a social reinforcement increased when the child was exposed to a prior period of social isolation (interpreted as deprivation). The effectiveness of the social reinforcer was diminished if the child was exposed to a prior condition of social satiation (1958a). Erickson (1962) showed that the condition of social deprivation enhanced the subsequent effectiveness of only a social reinforcement and did not enhance the effects of marble reinforcement.

The studies reviewed here have tried to determine the nature of social reinforcement. Some of the studies have shown that social reinforcers may be similar to other reinforcers for human and non-human subjects in that the effectiveness of the social reinforcer may be influenced by the subject's satiation/deprivation condition. Other studies have examined the function of social reinforcement in terms of information theory. Verbal comments of praise and correctness as well as critical comments have served as social reinforcers. The methods used and the variables examined in the different experiments varied widely, making it difficult to draw generalities from this body of research.

The present study is examining the effects of several configurations of social reinforcers that have been examined in the above studies. The basic social reinforcer used in the research combines a pleasant facial expression and tone of voice with comments of praise or correctness. One experiment examines the effects of positive social reinforcement and disapproving comments delivered after error responses.

Reinforcement Schedules

Morse (1966) pointed out that the effects of a reinforcer depend, in a large measure on the contingencies that specify when the reinforcement is delivered. The rate of behavior has been the basic datum for analyzing the effects of reinforcement schedules. Ferster and Skinner, 1957, recorded behaviors against time on a cumulative curve which showed the rate of responding each moment.

Ferster and Skinner found that the patterns and rates of responding were related to the types of reinforcement schedules and the frequency of reinforcement. With reinforcement schedules that delivered reinforcements on a variable basis, steady patterns of responding developed; with schedules that delivered reinforcements on a fixed basis, cyclic patterns of responding developed. Generally, higher rates of responding occurred on the ratio schedules than on the interval schedules when the frequency of reinforcement was the same for each schedule.

Handwriting behavior was operationally defined and electromechanically recorded and consequated by Gonzalez and Waller (1974). They found differential patterns of responding on fixed-ratio (FR) and fixed-interval (FI) schedules. On a FI five minute schedule, there were significant post-reinforcement-pauses in responding. The rate of responding for both schedules was bi-valued, either 0 or a sustained constant rate.

Staats, Finley, Minke, and Wolf (1964) investigated the effects of reinforcement schedules for reading responses with children. They compared four reinforcement schedules:

1. a schedule that delivered a reinforcer after every response (CRF)
2. a variable-ratio schedule
3. a variable-interval schedule
4. an extinction schedule that withheld reinforcement

For each child, two of the schedules were alternated during each session to form a multiple schedule (see Glossary) so that, for each session, comparisons were made between the rates of responding for the two schedules.

Reading rates were higher on the VR schedule, than on the CRF schedule. They were higher on the CRF schedule than on a VI schedule. The child exposed to a multiple VR and VI schedule did not differentiate between these contingencies. The lowest rates were on an extinction schedule.

These researchers felt that the multiple schedule design of their study was important for showing the differential effects of the reinforcement schedules. However, they felt that the differences in reading rates produced by the different schedules were not as great as those obtainable in more basic research where the response does not have to be taught. They suggested that in their study the learning process obscured the schedule effects. Quite often, the children had to go through a teaching procedure before they could emit the correct reading response.

Arithmetic responses were increased by Lovitt and Esveldt (1970) by providing greater reinforcement for higher rates of performance. They established a multiple-ratio schedule, such that a certain amount of reinforcement was delivered if a specified number of problems were done in a twenty-minute period. Greater amounts of reinforcement were given if higher numbers of problems were finished in the time limit.

This section has reviewed several studies that used reinforcement schedules which delivered the reinforcers as the subject was responding. In other studies reinforcement schedules were used that determined how many reinforcers were to be delivered at the completion of all the subjects' responding. In the first group of studies, differences in the rates of responding and in the patterns of responding were frequently noted for the different reinforcement schedules. In the second group of studies, differences in the overall rates of responding were noted for the different reinforcement schedules.

Reinforcement Effects on Academic Behaviors

In an investigation of the functional relationships of a reinforcement condition, Sidman (1960) emphasized the primary importance of the methods and techniques of the science. Advances in technology may occur in the areas of data collection and data analysis, but for science of behavior the most important advances are in the methods of behavior control. Findley (1962) noted that in his research the pursuit of behavioral control progressively took precedence over the statement of problems and answers, and in which it (control) was often pursued in their absence.

The influence of reinforcement contingencies on academic and achievement behaviors has been demonstrated through many procedures. The number and variety of words used by elementary students in written compositions has been manipulated through differential reinforcement contingencies (Brigham, Graubard, and Stans, 1972; Maloney and Hopkins, 1973). The rates of correct written mathematics responses have been increased through schedules of multiple-ratio contingencies that differentially reinforced higher rates of responding (Lovitt and Esveldt, 1970). Staats, Staats, Schultz, and Wolf (1962) showed that four-year old children would learn textual reading responses for edible and trinket reinforcers but would not remain at the training task for social reinforcement alone. A combination of social reinforcement and token reinforcement was used effectively in a classroom for increasing the students' percentage of time at work and work output per minute, (Chadwick and Day, 1971). When the token economy was discontinued and social reinforcement used alone, the students maintained their high rates of output per hour; however, the percentage of time that they spent at work decreased to the baseline level.

A child's learning and performance can be facilitated not only by the reinforcement provided after the response but also by the programming of stimuli presented to the child before his response.

Lovitt and Curtiss (1968) reinforced a child's correct written mathematics responses, but there was no increase in the percentage of correct responses until the child verbalized the problem before writing the answer.

The Performance Determined Instruction model makes curriculum changes based on the child's individual performance, Gray, Baker, and Stancyk (1969). This model uses the child's percent of correct flashcard responses for making program changes. By combining manipulations in motivational level, i.e., number of responses per token, with changes in curriculum level, the child's performance level can be maintained in the 90 to 94 percent correct range. Additionally, they found that children in their program of flashcard drills and textual reading drills showed a Gray Oral Reading Test growth of an average of one year growth for only 12 hours of instruction per child.

Lahey and Drabman (1974) in a study of normal school children, comparing verbal praise plus token reinforcement with verbal praise alone found that the token group not only reached the criterion for learning flashcards faster but also retained the words better over long retention intervals. In discussing these findings on retention of learning, Lahey and Drabman (1974) suggested that a procedure which facilitates acquisition will enhance retention.

These studies have shown that reinforcement procedures can facilitate a child's performance for many different academic responses. With reinforcement, the child will increase the amount of his work and sometimes he will improve the accuracy of his work.

When a child is learning a new response to new stimuli, there is a high probability that some error responses will be made. Holland and

Porter (1961), using a teaching machine procedure, found that having the subject repeat the incorrect items significantly improved comprehension.

Davidson and Osborne (1974) found that the reinforcement schedule for matching-to-sample task affected the distribution of error responses. On an FR schedule, the greatest number of errors occurred immediately after the delivery of reinforcement. On an FI schedule the greatest number of errors occurred in the second quarter of the interval. On the VR and VI schedules there were no systematic patterns of errors.

Zimmerman and Baydan (1963) demonstrated with children on a matching-to-sample task that when a timeout condition immediately followed an error that the number of errors decreased. Additionally, they obtained higher levels of accuracy when the duration of the timeout was increased and a decrease in accuracy when the timeout was imposed less frequently.

For the present research, a reading curriculum (Scientific Research Associates Lab la) was selected that has 20 lesson cards constituting a curriculum unit. These curriculum units were reorganized into four curriculum units of 5 cards each. A criterion of an average of 90% accuracy for the stories in the unit was required to advance to the next unit. This reorganization was done so that the educational decision of advancing the child to the next curriculum unit would be done four times more frequently. Additionally, flashcards were made with words from the stories because sight recognition of individual words was felt to be a target behavior of an oral reading program.

CHAPTER III
PROCEDURES

The procedures employed in these studies will be presented in the following order: 1) Subjects and Tutors, 2) Curriculum Programming, 3) Reinforcement, 4) Data Recording Procedures, 5) Experimental Procedures, 6) Social Behaviors of the Subject. The next chapter presents a brief description of the procedures unique to each of the four experiments, followed by the results of each experiment.

Subjects and Tutors

The subjects were six boys and one girl enrolled in the third grade in a local elementary school. The children were selected by their teachers as being problem readers. Each child worked with a tutor in a semi-isolated space of a classroom that was used exclusively for this research. The tutors were university students enrolled in an Experimental Psychology laboratory course. The tutor worked with the child for nine week experimental terms.

The tutor presented the materials to the child, recorded his academic and social behaviors and delivered the scheduled reinforcer which was either a token or social reinforcer. These different events were recorded on a data sheet (see Appendix A) as they occurred.

Generally, two tutors worked with each child on alternate days. Each tutor was associated with a different experimental condition so that the child received each experimental condition on alternate days and eacb tutor could function as a discriminative stimulus for his specific condition.

Curriculum Programming

General Program

The children came to the experimental classroom for one hour per day; 40 minutes were allotted for academic drills and 20 minutes for reinforcing activities and material (see Table 1). The SRA (Scientific Research Associates 1963) reading program (Lab 1a) was used for the academic drills. In addition, flashcards were made of individual words from the stories. The first task each session was the flashcard drill which lasted for a fixed time of either 10 or 20 minutes. After the flashcard drill, each child read the story from which the flashcards were derived. Three to ten minutes were allotted for reading the story. The remainder of the period consisted of writing exercises and phonetic drills. During the academic tasks, each child received tokens and social reinforcers on separate conjoint schedules of reinforcement. The token reinforcers were ink marks on a ditto form (see Appendix B) that could be exchanged after the work period for minutes of free play, candy, and Polaroid snapshots.

Table 1. Daily Session

(a) Flashcard Drill	(b) Reading one Story	Writing Exercises	Phonics	Play Period & Token Exchange
10 minutes	3-10 minutes	10-15 minutes	10-15 minutes	20 minutes
--------------Total 40 minutes			--------------------------	20 minutes

Experimental manipulations were made during the (a) flashcard drills and (b) reading story. The data were collected from these exercises.

Reading Curriculum

The SRA program has eight reading levels which range from the first grade to the middle of the third grade. Only the first five reading levels were used in these studies. Each level is comprised of twenty short-story cards. The stories in the levels were divided by the experimenter into four groups of five stories that were designated as units (see Table 2). The child read one story each day.

Table 2. Curriculum Program

Reading Level	Unit	Stories
Gold 1.1	G1	1-5
	G2	6-10
	G3	11-15
	G4	16-20
Aqua 1.4	A1	1-5
	A2	6-10
	A3	11-15
	A4	16-20
Purple 1.7	P1	1-5
	P2	6-10
	P3	11-15
	P4	16-20
Orange 2.0	O1	1-5
	O2	6-10
	O3	11-15
	O4	16-20
Olive 2.3	Ol1	1-5
	Ol2	6-10
	Ol3	11-15
	Ol4	16-20

Each reading level consisted of four units and each unit contained five stories.

After reading the five stories in a unit, if he read the stories with an average accuracy of 90% of the words read correctly, then he advanced to the next unit. If he did not meet that criterion, he reread the story with the lowest accuracy of response. If he still did not have an average accuracy of 90% of the words read correctly, he reread the story with the next lowest accuracy ratio. The child was not allowed to read the same story two days in a row. When he had an average accuracy of 90% correct for all the stories in the unit, he advanced to the next unit. Flashcards consisted of words taken from the stories. The set of flashcards derived from all the stories in a given unit was used each day that the child was reading a story in that unit. Ten to fifteen words were selected from each story for the flashcard set. If a word had been selected from a previous story then it was not used again.

When the child made an error, during either the flashcard or reading exercise, the tutor provided the correct response which the child repeated. For the flashcard drill, during which approximately 60 cards were presented, the tutor placed error cards in an error pile until five cards were accumulated in that pile. Then, the cards in the error pile were presented until there were two or less cards left at the end of a turn through that pile. The tutor would then resume with the stack of unpresented cards until there were, again, five cards in the error pile. With this procedure, each card was presented and represented until it was said correctly. During the reading exercise, when an error response was made, the subject repeated the correction that the tutor provided and proceeded to the next word.

Reinforcement Procedures

The standard social reinforcement after a correct response consisted of a brief positive comment of praise, accompanied by friendly facial expressions, and a congenial tone of voice. This social reinforcement arrangement was employed in all the experiments except those in which one of the following three alternative social reinforcement conditions were studied: 1) standard social reinforcement delivered after an error; 2) a high intensity (Hi) social reinforcement condition in which the tutor touched the arm or back of the child and made a subject or task related positive comment; or 3) a disapproving social comment delivered after an error response (see Appendix C).

The token and social reinforcers were delivered on separate and independent conjoint schedules of reinforcement (see Glossary). In each experiment, different reinforcement schedules were used for the token and social reinforcements. The reinforcement schedules used most frequently were interval schedules. For these schedules, the reinforcement was delivered following a response that occurred after a specified period of time had elapsed. A fixed-interval 90 seconds schedule was used for the token delivery in most of the studies, (FI 90 sec Tok). On this schedule, the token was delivered following the first correct response after each 90 second interval. A variable-interval 60 seconds schedule was used for the delivery of social reinforcement in several studies (VI sec Soc); the reinforcer was delivered following a response after an average interval length of 60 sec. (For one interval, the duration may have been 45 seconds and for another it may have been 75 seconds. These schedules were combined as conjoint schedules and indicated as Conj (VI 60 sec Soc, FI 90 sec Tok).

Reinforcers were scheduled for these time intervals by listing time values on a small card so that the tutor could refer to this card and his timing device and reinforce the first correct response after his timer had reached a certain value. The intervals on these schedules were timed from the moment when the previous reinforcement became available.

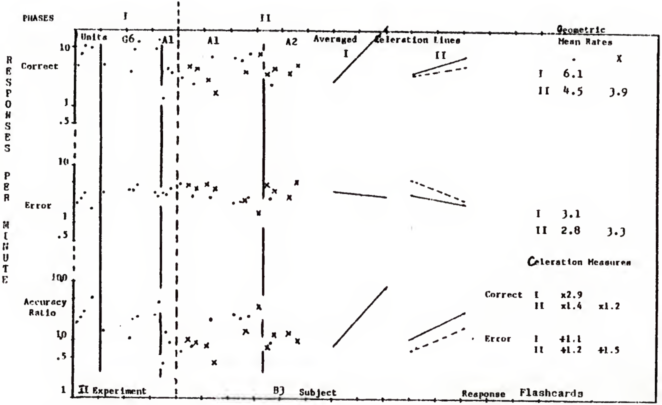
For some of the experiments, the reinforcers were delivered on a ratio schedule in which the reinforcer was delivered following a response after a specified number of responses had been emitted. On a fixed-ratio 6, (FR 6) schedule, the reinforcer was delivered for every six correct responses. On a variable-ratio 3, (VR 3) schedule, the reinforcer was delivered for every three responses on the average; (one time it may have been delivered following a single response, another time after five responses, etc.). Other schedules were used in some experiments and they will be described when those schedules are introduced.

Data Recording Procedures

The tutor recorded the subject's daily responses on a standard data form (see Appendix A). During sessions it was necessary for the tutor to count the occurrence of error responses as they were being made and to record the social reinforcements as they were delivered. For some experiments, the tutors were also recording certain social behaviors that will be described later. At the end of each session, it was possible to determine the number of correct responses for each curriculum by counting the number of flashcards in the correct pile or by subtracting the number of errors from the total number of words in the story.

The reliability of the tutor's data recording and reinforcement delivery was assessed by having an observer periodically watch and record the behaviors of each tutor and child. The observers could see the tutor recording data but could not see the nature of the data. Additionally,

Key to Behavior Figures



• Tuter ———— X Tutor - - - - - -

PHASES

I Baseline Conj(FI 90" Soc, VI 90" Tok)

II Conj(FI 90" Soc, VI 90" Tok) Conj(VR 3 HI Soc, VI 90" Tok)

Daily response rates are on the left side of the graph. The .,———and x,----- correspond to the reinforcement conditions shown at the bottom of the figure. The ordinate consists of 2 logarithmic scales of Responses Per Minute. Correct response data are on the top scale, Error response data are on the middle scale, and Accuracy Ratio data are on the bottom scale. The experimental Phases are indicated by roman numerals above the graph, with dashed vertical lines indicating when the phase changed. Curriculum Units are indicated by letters at the top of the graph with solid vertical lines indicating when the unit changed.

Summary data are presented on the right side of the graph. The Averaged Celeration Lines summarize the corresponding Correct, Error, and Accuracy Ratio data for each experimental phase. The Geometric Mean Rates summarize, for each reinforcement condition, the Correct data at the top and the Error data in the middle. The Celeration Measures are the slopes of each celeration line. At the bottom of the figure, the reinforcement conditions are presented for each experimental phase.

some of the recording procedures described above allowed the tutor to continuously recheck his own data.

Daily Behavior Charts

The daily data were used to calculate the means of the rates of performance for each reinforcement schedule condition. Standard Daily Behavior Charts, (see Chart Key), (Pennypacker, Koenig, and Lindsley, 1972), were compiled with the daily mean rates of correct and error responses as the data points. Accuracy ratios were computed from the correct and error response rates and included on the graphs. The data were summarized with celeration lines on the graphs. A multiplied acceleration measure indicates that the slope increased, a divided deceleration measure indicates that the slope decreased. The authors describe the Quarter-Intersect method (see Glossary) for determining the celeration line so that teachers and behavior managers can determine these statistics.

In the determination of the celeration lines, data were considered only if there were at least three days of data for each reinforcement condition in that curriculum or experimental phase. One exception to this rule is noted in the results of Experiment III.

Sequence Data

Sequences of consecutive error flashcard responses were recorded in Experiments I and IV. In Experiment I, sequences of consecutive correct flashcard responses were also recorded. The tutors marked error and correct responses on a grid on the data sheet. In Experiment IV, they skipped a space for one or more correct responses. The number of sequences for each length of consecutive error responses were determined. Frequency distributions and conditional probabilities were determined.

Comparisons were made between the conditional probabilities and frequencies of sequences of two consecutive responses, short sequences, and sequences of three or more consecutive responses, long sequences.

Cumulative Records

In Subexperiment II B for Child B2, the scheduling of the reinforcements and the recording of the data were done with electromechanical relay equipment. The tutors pressed correct and error buttons on a control box that was connected to programming and recording equipment in a sound attentuating cabinet in an adjacent room. During the flashcard performance, the responses were recorded and cumulative records of correct responses obtained.

Token reinforcers were delivered by the tutor following a brief flash of red light positioned in front of the child. Social reinforcers were delivered following the first correct response after a small light on the control box was illuminated. This light was visible to the tutor but could not be seen from the child's sitting position. The cumulative records provide a pictorial representation of the correct flashcard responses for B2.

Experimental Procedures

The basic experimental paradigm was to associate each tutor as a discriminative stimulus with a particular reinforcement condition, and to compare the reading performances of the subjects across two of these conditions. Three baseline and experimental procedures were used for the comparisons of the different experimental conditions.

For one baseline, two tutors alternated for every other session and used different reinforcement schedules. The experimental phase was a reversal between the tutors and the reinforcement conditions.

For the second baseline procedure, one tutor worked with the child every session during the baseline phase. During the experimental phase, a second tutor alternated every other session with the first tutor and used a different reinforcement contingency.

For the third baseline procedure, two tutors alternated for every other session but used the same reinforcement schedules. During the experimental phase, one tutor continued using the same reinforcement schedules and the other tutor used a new schedule.

In each experimental phase, two reinforcement conditions were compared on alternate days. This arrangement defined a multiple schedule with both tutors and their reinforcement conditions alternating every 24 hours as the schedule components. Each component of the multiple schedule included the conjoint social and token reinforcement schedules.

Experiment I was the only experiment that did not employ a multiple schedule with alternating tutors for making the comparisons between reinforcement conditions. Both of the comparison social reinforcement schedules were presented each session by the same tutor for the entire experiment. Each social reinforcement condition was in effect for alternate five minute periods during the flashcard drill. Since the same stimulus was associated with the two reinforcement conditions, this arrangement can be formerly conceptualized as a Mixed Schedule.

Social Behaviors of the Subject

For Experiment II, the tutors and observers recorded three classes of social behaviors: irrelevant talking episodes, episodes of turning away from the work, and negative comments. If an individual subject exhibited an idiosyncratic behavior of pattern of behaviors that appeared to be related to the tutoring sessions, then the tutors and observers counted these behaviors separately. After Experiment II, the three classes of social behaviors were no longer recorded. The tutors continued to record idiosyncratic behaviors of the children which were related to their academic performance.

The tutors were instructed to ignore disruptive or inappropriate social behaviors of the subject. If a subject did not like a tutoring session, he was informed that he could leave with the stipulation that he could not come back later in that session, but that he could come to the next session.

Summary

This chapter provided an overview of the procedures designed to investigate the effects of both social and token reinforcement on the reading behaviors of children. Included were descriptions of the subjects and tutors, the materials and their presentation, and the reinforcement and data collection procedures. The next chapter provides a brief introduction of the procedures unique to each experiment followed by a presentation of the results for each experiment.

CHAPTER IV
EXPERIMENTS

The four experiments are presented separately with a procedures section, a results section, and a discussion section for each experiment. Each of these sections are presented in relation to the individual children since different experimental variables were examined for each child (see Chart 1).

Experiments I and II compare the effects of intermittent reinforcement schedules and the effects of two magnitudes of social reinforcers. In Experiment I, a condition of No-Social reinforcement, i.e., an Extinction schedule, is compared with a VR schedule of social reinforcement. In Experiment II, three different schedule comparisons are made: 1) between an FI 30 sec and FI 300 sec schedule of social reinforcement; 2) between an FI 90 sec and an FR 6 schedule of token reinforcements; and 3) between a VR 3 schedule of High Intensity social reinforcement and an FI 90 sec schedule of social reinforcement. These schedules varied in the frequency of reinforcement and in the type of contingency between the behaviors and the reinforcers.

Experiments III and IV compare the effects of social comments delivered after correct or after error responses. In Experiment III, the social reinforcers were delivered after correct responses on one schedule and on the other schedule social reinforcers or social disapproval were delivered after error responses. The schedules that delivered social reinforcers after error responses are analagous to the classroom situation of the teacher providing attention to the child as she corrects his errors.

In Experiment IV, a Tandem Brief-Stimulus schedule reinforced a specific sequence of error and correct responses. The alternate schedule only reinforced correct responses. By reinforcing a sequence of responses, the effects of the reinforcers can be determined by analyzing the occurrences of the sequences of responses as well as by analyzing the rates of the individual responses.

Chart 1. Experimental Comparisons

. Chart shows which children were in each experiment and the reinforcement conditions that were being compared. Experiments I and II compared different schedule values. Experiments III and IV examined the effects of reinforcements on correct and error responses.

	Experiment I	Experiment II	Experiment III	Experiment IV
G1	Mixed (VR 3 Soc) (Ext Soc)			Tandem (FR 3 Soc Err CRF Tok Cor) Mult Conj (VI 90 sec Soc Cor FR 6 Tok Cor)
B4	Mixed (VR 3 Soc) (Ext Soc)			
B2		Mult (FI 30 sec Soc) (FI 300 sec Soc) Mult (FR 6 Tok) (FI 90 sec Tok)		
B3		Mult (VR 3 Hi Soc) (FI 90 sec Soc)	Mult (VI 60 sec Soc Cor) (VI 60 sec Soc Err)	
B1			Mult (VI 60 sec Soc Cor) (VI 60 sec Dis Err) Mult (VI 60 sec Soc Cor) (VI 60 sec Soc Err)	
B5			Mult (VI 90 sec Soc Cor) (VI 90 sec Dis Err)	
B6				Tandem (FR 3 Soc Err, CRF Tok Cor) Mult Conj (VI 90 sec Soc Cor, FR 6 Tok Cor)

Experiment I

Experiment I compared the presentation of social reinforcement with the withholding of social reinforcement. This comparison is a basic test of the effectiveness of the social comments to function as a reinforcer. A reinforcer is defined by its effect of enhancing responding when it is delivered contingent upon that responding.

These conditions were alternated during the flashcard drill each session. The flashcard drill was twenty minutes long with four five-minute components. Five minute comments with a (VR 3 Soc,) schedule were alternated with five-minute components with an (Ext Soc) schedule (Phase I). Token reinforcers were delivered on FI 90 sec during both components. Therefore, in one component social reinforcement and token reinforcement were available and in the other component only token reinforcement was available. There were no changes in discriminative stimuli associated with these alternating components. The combined schedule for the flashcard drills was Conj (Mixed (VR 3 Soc,, Ext Soc), FI 90 sec Tok) schedule. (See Contingency Chart I.)

The two children worked with one tutor during the experiment. For child G1, the experimental conditions remained the same throughout. For child B4, the only change in the experimental conditions was that the alternating components were lengthened to ten minutes each during the latter half of the experiment (Phase II).

Contingency Chart I

EXPERIMENT I

			No. of Sessions
G1	*	Conj (Mixed (VR 3 Soc, Ext Soc), FI 90 sec Tok)	15
B4	I*	Conj (Mixed (VR 3 Soc, Ext Soc), FI 90 sec Tok)	19
	11*	Conj (Mixed (VR 3 Soc, Ext Soc), FI 90 sec Tok)	34

The VR 3 Soc and Extinction Soc Components alternated within each session.

* 5 minute components
** 10 minute components

In addition to examining the rate measures of the children's performances, the patterns of sequences of the correct and error responses were examined for child B4.

During Phase II, frequency distributions of the sequences of responses were determined for the VR 3 Soc and Ext Soc schedules. Frequencies were compared for sequences of 2 correct and 2 error responses in a row, short sequences, and for long sequences of more than 2 correct or 2 error responses in a row. Additionally, frequencies were compared for the last 3 sessions in two curriculum units.

Results - Experiment I

Child G1

Child G1 responded at higher rates of both correct and error responses under the Ext Soc than under the VR 3 Soc schedule. She responded at 7.1 and 1.9 responses per minute, respectively, for correct and error responses under the Ext Soc schedule and 6.0 and 1.4 responses per minute, respectively, under the VR 3 Soc schedule (see figure 1). This difference in overall response rates was very consistent, occurring in nearly all sessions.

Although the rates of responding were different for the two conditions, the overlap of the celeration lines for the accuracy ratios of both conditions indicates that the accuracy ratios of the flashcard responses were similar for both the Ext Soc and VR 3 Soc schedules.

Child B4

The results were considerably different for child B4. In both phases, the rates of correct responses were slightly higher under the

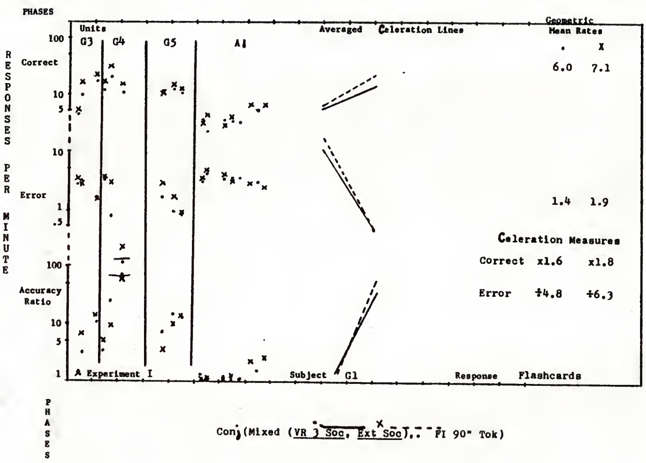


Figure 1. Flashcard performance of child G1 in Experiment I.

VR 3 Soc schedule than under the *Ext Soc* schedule (6.4, 4.5 and 6.2 , 4.2 responses per minute, respectively; see figures 2 and 3). In contrast, the error response rates in both phases were lower under the *VR 3 Soc* schedule than under the *Ext Soc* schedule (3.8, 3.7 and 4.2, 3.9 responses per minute, respectively). In both phases, there was a greater acceleration in the Accuracy Ratio under the *VR 3 Soc* schedule.

Sequence data for B4

Table 3 shows that the frequency distribution of sequences of correct and error responses were different for the two reinforcement conditions. There was a greater frequency of long sequences of successive errors during *Ext Soc* and of long sequences of successive correct responses during *VR 3 Soc*.

Table 3.

Average Frequency of
Sequences of Correct and Error Responses
per Ten Minute Component

Sequences	VR Component	Ext Component	Number of Sessions
Short 2 Errors in Row	4.0 Sequences	3.5 Sequences	24
Long, More than 2 Errors in Row	4.4 Sequences	5.4 Sequences	24
Short 2 Corrects in Row	2.5 Sequences	4.2 Sequences	13
Long, More than 3 Corrects in Row	6.2 Sequences	4.9 Sequences	13
Average for the Last 3 Sessions in a Curriculum Unit			
Short 2 Errors in Row	4.0 Sequences	2.5 Sequences	6
Long, More than 2 Errors in Row	2.2 Sequences	3.8 Sequences	6

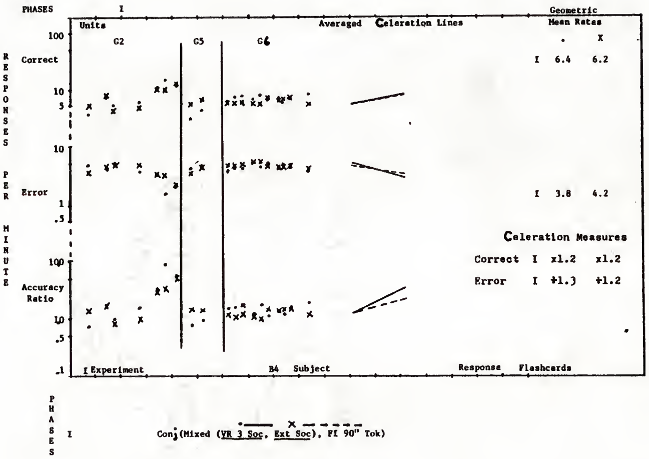


Figure 2. Flashcard performance of child B4 in Experiment I, Phase I.

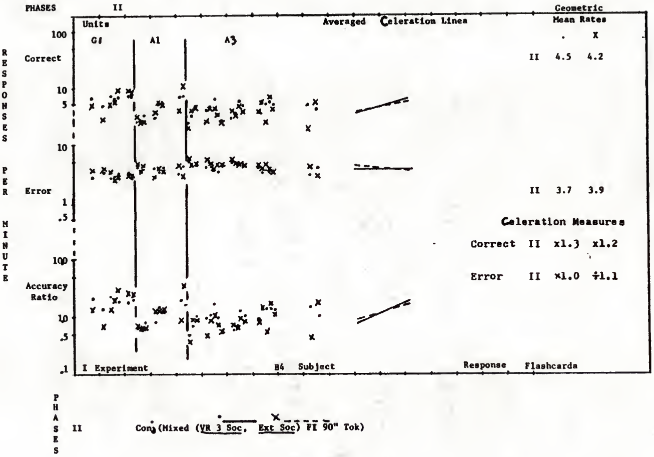


Figure 3. Flashcard performance of child B4 in Experiment I, Phase II.

The top section of Table 3 shows that there was a greater frequency of short sequences of error responses during the VR component and a greater frequency of long sequences of error responses during the Ext component. The middle section shows that there was a greater frequency of short sequences of correct responses during the Ext component and a greater frequency of long sequences of correct responses during the VR component. The bottom section shows that during the last three sessions in a curriculum unit there was an even greater frequency of short sequences of error responses during the VR component and a greater frequency of long sequences of error responses during the Ext component.

Summary - Experiment I

The data from this experiment showed contrasting effects between the two children under the Ext Soc and VR 3 Soc components. Child G1 responded at higher rates of correct and error flashcard responses during the Ext Soc component in nearly all sessions, but the accuracy ratios of G1 were nearly equivalent for the two different social reinforcement conditions.

Relative Mean Response Rates
Child G1

	Ext Soc	VR 3 Soc
Correct	Higher	
Error	Higher	

Child B4 responded at a greater rate of correct responses and lower rate of error responses under the VR 3 Soc component. There was a greater growth in the accuracy ratio under the VR 3 Soc component.

There was a greater growth in the accuracy ratio under the VR 3 Soc component. These relationships developed in both phases for child B4. The sequence data showed that there were differences in the patterns of responding under the two schedules. There were greater frequencies of long sequences of error responses under Ext Soc and of long sequences of correct responses under VR 3 Soc. The differences in the patterns were even greater during the last 3 sessions of each curriculum unit.

Relative Mean Response Rates
Child B4

	Ext Soc	VR 3 Soc
Phase I		
Correct		Higher
Error	Higher	
Phase II		
Correct		Higher
Error	Higher	

Since child G1 responded at uniformly lower rates for both correct and error responses under the VR 3 Soc schedule, the presentation of the social reinforcer may have distracted the child and caused a disruption in responding. However, child B4 responded differentially under the VR 3 Soc schedule, with higher rates of correct responses and lower rates of error responses. Therefore, the social comments enhanced the correct responding and function as reinforcements for Child B4.

Experiment II

In Experiment II, the effects of different intermittent reinforcement schedules and different magnitudes of social reinforcers were compared.

These reinforcement schedules varied in the frequency of reinforcement delivery and in the type of contingency between the behaviors and the reinforcers. Research has shown that a subject's rate of responding is related to both the frequency of reinforcement and the contingency of reinforcement (Ferster and Skinner, 1957).

Two children, B2 and B3, were subjects in this experiment. B2 was involved in two separate Subexperiments that are included in Experiment II. In Subexperiment IIA for B1, two different durations of FI schedules of social reinforcements were compared, FI 30 sec Soc and FI 300 sec Soc. In Subexperiment IIB for B2, the effects of an FR 6 Tok schedule of token reinforcement were compared with the effects of FI 90 sec Tok schedule of token reinforcement. With child B3, an FI 90 sec Soc schedule with the standard social reinforcement was compared with a VR 3 HI Soc schedule with a high intensity social reinforcement.

Child B2

In Subexperiment IIA, the effects of the durations of the FI schedules of social reinforcement were examined. For child B2, one tutor employed a FI 30 sec Soc schedule while the alternate tutor

Contingency Chart 2

SUBJECT B2

	Tutor	Flashcards	Reading	No. of Sessions
Subexperiment IIA	A	Conj (FI 30 sec Soc, VI 90 sec Tok)	Conj (FI 30 sec Soc, VI 90 sec Tok)	13
	B	Conj (FI 300 sec Soc, VI 90 sec Tok)	Conj (FI 300 sec Soc, VI 90 sec Tok)	11
Subexperiment IIB				
I. Baseline	C	Conj (VI 90 sec Soc, FI 90 sec Tok)	Conj (VI 90 sec Soc, FI 90 sec Tok)	9
	D	Conj (VI 90 sec Soc, FI 90 sec Tok)	Conj (VI 90 sec Soc, FI 90 sec Tok)	7
II.	C	Conj (VI 90 sec Soc, FR 6 Tok)	Conj (VI 90 sec Soc, FR 15 Tok)	9
	D	Conj (VI 90 sec Soc, FI 90 sec Tok)	Conj (VI 90 sec Soc, FI 90 sec Tok)	6
III. New Tutors	E	Conj (VI 90 sec Soc, FR 6 Tok)	Conj (VI 90 sec Soc, FR 15 Tok)	11
	F	Conj (VI 90 sec Soc, FI 90 sec Tok)	Conj (VI 90 sec Soc, FI 90 sec Tok)	13

employed a FI 300 sec Soc schedule for both the flashcard and reading performances. Token reinforcers were delivered on a VI 90 sec Tok schedule during both conditions (see Contingency Chart 2).

In Subexperiment IIb, the effects of FR schedules of token reinforcement were compared with the effects of FI schedules of token reinforcement. In the baseline phase I, both tutors employed the same FI 90 sec Tok schedule for the flashcard and reading performances. In phase II, one tutor continued to employ the FI 90 sec Tok schedule for the flashcard and reading performances, and the alternate tutor changed to a FR 6 Tok schedule for the flashcard performance and a FR 15 Tok schedule for the reading performance. In phase III, the same reinforcement contingencies were being compared but with two new tutors. Social reinforcement was delivered on a VI 90 sec Soc schedule for both conditions in each phase (see Contingency Chart 2).

Cumulative Records

In Subexperiment IIB, the scheduling of the reinforcements and the recording of the data were done with electro-mechanical relay equipment. Responses were recorded on cumulative records which graphically presented the responses as they occurred moment-to-moment. (See Chapter III.)

Child B3

The effects of an FI schedule with the standard social was compared with a VR schedule with a high intensity social reinforcer. Token reinforcers were delivered on a VI 90 sec Tok schedule in all conditions.

During a three week baseline, child B3 worked with the same tutor each session. This tutor delivered the social reinforcers on a

Contingency Chart 3

SUBJECT B3

Phase	Tutor	Flashcards	Reading	No. of Sessions
I. Baseline	A	Conj (FI 90 sec Soc, VI 90 sec Tok)	Conj (FI 90 sec Soc, VI 90 sec Tok)	13
II.	A	Conj (FI 90 sec Soc, VI 90 sec Tok)	Conj (FI 90 sec Soc, VI 90 sec Tok)	7
	B	Conj (VR 3 HI Soc, VI 90 sec Tok)	Conj (FI 90 sec HI Soc, VI 90 sec Tok)	10

FI 90 sec Soc, for the flashcard and reading performances. After this three week baseline, a second tutor began working with B3 on alternate days. This new tutor provided the high intensity social reinforcement on a *VR 3 HiSoc* schedule during the flashcard drills. During the textual reading, this second tutor delivered the high intensity social reinforcement on a *FI 90 sec HiSoc* schedule. During this alternation with the second tutor, the first tutor continued employing the *FI 90 sec Soc* schedule for social reinforcements (see Contingency Chart 3).

Social Behavior and Reliability Measures

In Subexperiment IIA with B2, the tutors recorded classes of social behaviors that were previously described, talking out episodes, turning away, and negative comments. An observer watched all the sessions for this subject and recorded all the same data that the tutors were recording, in order to determine the reliability of the data and tutoring procedures.

Results - Experiment II

Child B2

Subexperiment IIA

The effects of the duration of the FI schedule of social reinforcement on both flashcard and reading performance are shown in figures 4 and 5, respectively. Overall, rates of both correct and error flashcard responses were slightly higher under *FI 30 sec Soc*, 5.5 correct and 4.9 error responses per minute, respectively, than under *FI 300 sec Soc*, 5.0 correct and 4.3 error responses per minute, respectively. The most apparent difference in the flashcard performances associated with the two schedules was found in the acceleration measures for correct responses. There were greater accelerations in correct flashcard

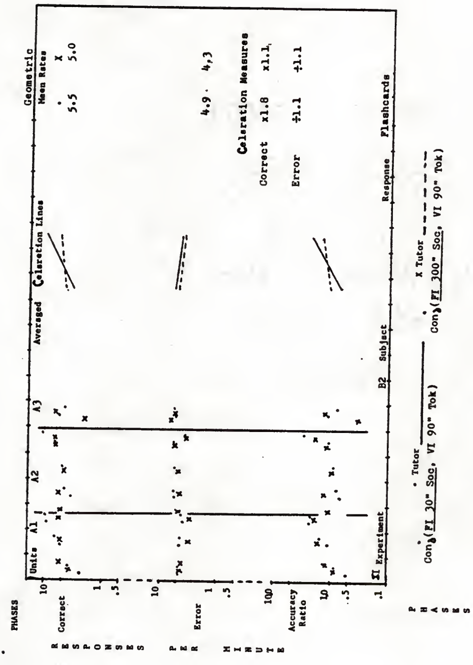


Figure 4. Flashcard performance of child B2 in Experiment II.

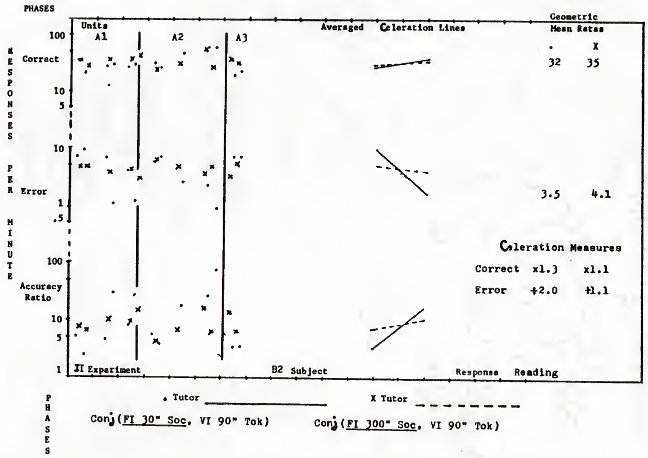


Figure 5. Reading performance of child B2 in Experiment II.

response rates and in the accuracy ratio under the FI 30 sec Soc schedule. See figure 4.

In contrast to the data for flashcard responses, the data in figure 5 for reading responses showed that there were overall higher rates of both correct and error reading responses under FI 300 sec Soc, - 35 correct and 4.1 error responses per minute, than under FI 30 sec Soc, - 32 correct responses and 3.5 error responses per minute.

The most apparent difference in the reading performances associated with the two FI schedules was found in the deceleration measures for the error reading responses. The error reading response rate under the FI 30 sec Soc schedule decelerated at a rate of ÷ 2.0 responses per minute per week while the error response rate under the FI 300 sec Soc schedule decelerated at a rate of ÷ 1.1 responses per minute per week.

Child B2
Subexperiment IIB

The effects of the FR and FI schedules for token reinforcement are shown in figures 6, 7. During the baseline phase of Subexperiment IIB, when the alternating tutors employed the same FI 90 sec Tok schedule there was a greater rate of correct responses in the presence of Tutor C than with Tutor D (4.6 and 4.2 responses per minute, respectively).

During phase II when Tutor C delivered token reinforcement on the FR 6 Tok schedule, there was a reversal in the relative performances of child B2 for the two tutors. There was a greater rate of correct flashcard responses with Tutor D, on the FI 90 sec Tok than with Tutor C on the FR 6 Tok - 4.4 and 3.7 responses per minute, respectively. In addition, there was a deceleration in correct flashcard response rates

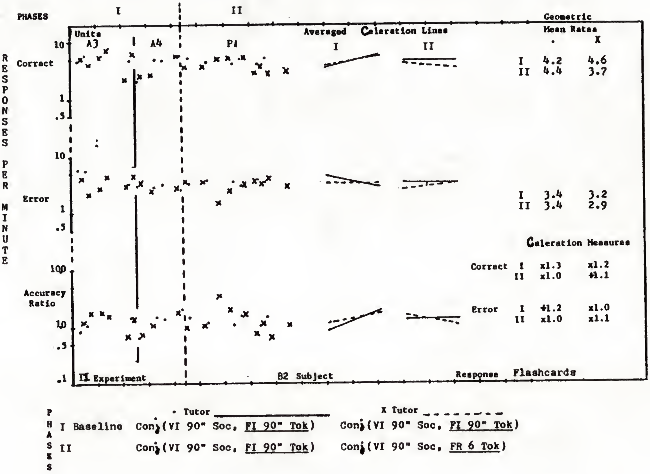


Figure 6. Flashcard performance of child B2 in Experiment II.

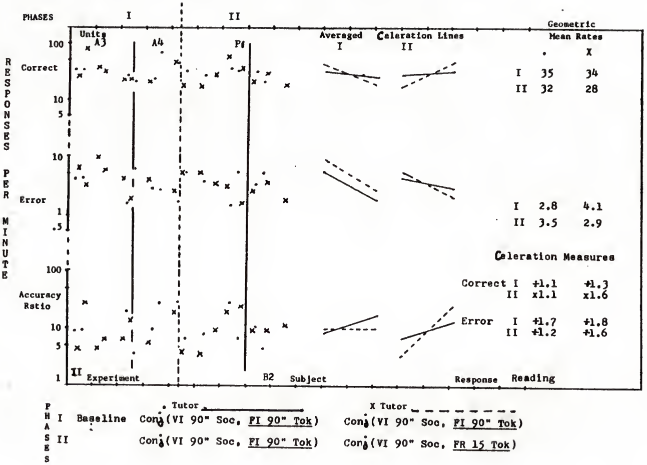


Figure 7. Reading performance of child B2 in Experiment II.

(÷ 1.1 responses per minute per week) and an acceleration in error response rates (x 1.1 responses per minute per week) with the FR 6 Tok schedule (see figure 6).

For reading during the baseline phase, there was no difference in the correct response rates with the tutors, and with both tutors there was a deceleration in the correct response rates (Tutor C ÷ 1.3, and Tutor D ÷ 1.1 responses per minute per week.) However, there was a greater rate of error responses with Tutor C than Tutor D (4.1 and 2.8 responses per minute, respectively) (see Graph 7). In phase II, there were greater rates of correct and error responses with Tutor D, with the FI 90 sec Tok schedule than with Tutor C and FR 15 Tok schedule. As noted above, the correct response rate for flashcards was also higher under the FI 90 sec Tok schedule. There was an acceleration in correct response rates for Tutor C (x 1.6 responses per minute per week) and Tutor D (x 1.1 responses per minute per week) which was a change from the deceleration for both tutors in phase I.

In phase III, B2 worked with two new tutors who continued using the FR 6 Tok and FI 90 sec Tok schedules. There were essentially no differences in the rates of correct or error responding on the different FI and FR schedules for reading or flashcards (see figures 8 and 9). There were similar acceleration measures for the correct responses for reading and flashcards on both schedules. For the error responses, there was a greater deceleration in reading and flashcard error responses with the FI 90 sec Tok schedule.

Cumulative Records

Cumulative records were made of the flashcard performances of B2 for the experimental phases of Subexperiment IIB.

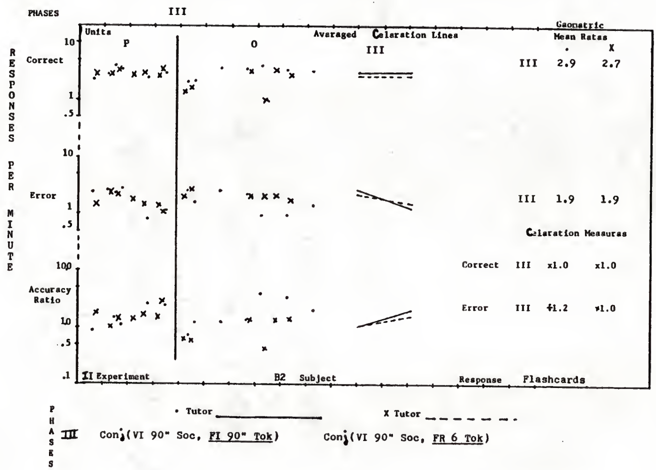


Figure 8. Flashcard performance of child B2 in Experiment II.

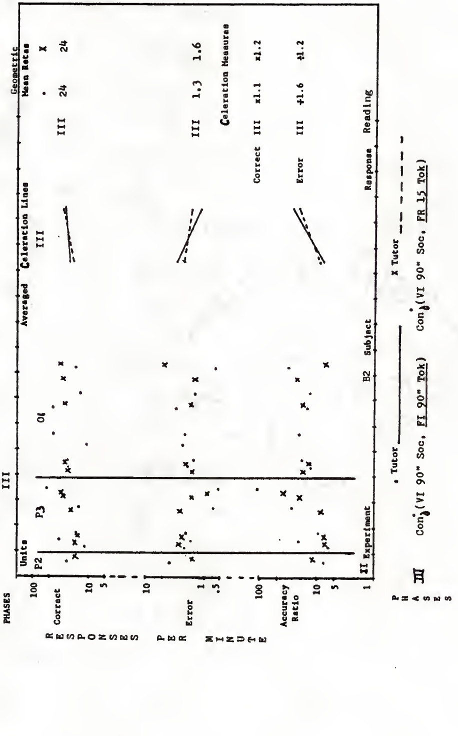


Figure 9. Reading performance of child B2 in Experiment II.

The cumulative records from selected sessions were numerically analyzed by measuring the number of millimeters the records had moved up the page during the sessions. The millimeters of movement were converted to the number of responses by multiplying by 4.6. (See Glossary.) Seven sessions were selected for both the FI and FR schedule conditions. (Six records were analyzed from the end of Phase II, three records from each reinforcement condition. Eight records were analyzed from the end of Phase III, four from each reinforcement condition. This was the greatest number of records that could be measured so that an equal number of records were measured from each reinforcement condition within the last ten sessions from each phase.)

Each cumulative record was divided into three equal time segments. The number of responses that were made during each of the time segments was added together for all seven sessions for each reinforcement condition. (See Table 4 .) The percentage of responses that occurred for each time segment is shown for both reinforcement schedules.

Table 4 shows that the total number of responses from the two groups of records were quite similar, 284 responses for the FI 90 sec Tok component and 294 responses for the FR 6 Tok component. However, the number of responses that occurred during each third time segment was different for the two groups of records. For the records from the FI 90 sec Tok component, there was a nearly even distribution of responses for each third segment, with 30-40% of the responses occurring in each third. For the records from the FR 6 Tok component, 50% of the responses occurred during the initial third segment of the session and only 19% of the responses occurred in the last third segment.

Table 4. Distribution of Responses During Intervals of Session

Proportion of Session	FI 90 sec Tok Cor		FR 6 Tok Cor	
	Responses	Percent	Responses	Percent
First 1/3	110	38%	147	50%
Second 1/3	87	31	92	31
Third 1/3	87	31	55	19
	284	100%	294	100%
	Seven Sessions		Seven Sessions	

This numerical analysis shows that the distribution of responses that B2 emitted for each third segment were different for the two reinforcement schedules.

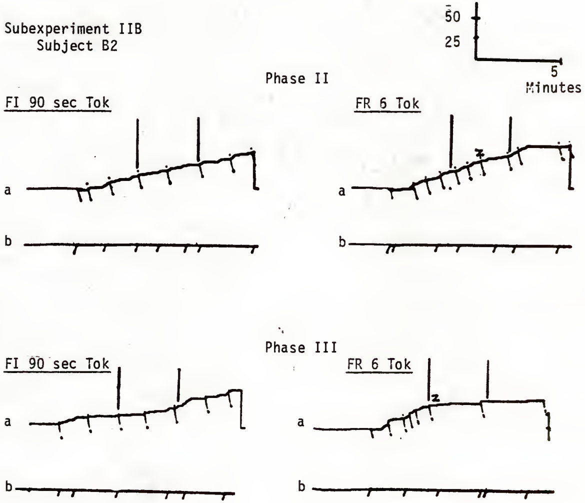
The records in Chart 2 were selected because they showed most clearly the different patterns of responding on the different schedules. Distinctive patterns of responding developed under each of these schedules for both Phases II and III. Under the FR 6 Tok schedule, higher rates of more sustained responding occurred during the first segment of the flashcard session. In the last segment of the session, long pauses of no responding were interspersed with short periods of responding.

Under the FI 90 sec Tok schedule, there was no difference in responding between the first and last segments of the flashcard session. Throughout each session, short pauses in responding were interspersed with periods of responding.

Child B3

During the baseline Phase I, B3 worked with one tutor and the FI 90 sec Soc schedule. In the experimental Phase II, B3 responded at

Chart 2. Cumulative Records of Correct Flashcard Responses



The a-line of each record shows the correct flashcard responses of B2 with the slash marks indicating the delivery of the token reinforcer. The b-line indicates by the slash mark the delivery of the social reinforcer. The top records are from Phase II and the botttom records are from Phase III. The schedule condition is indicated above each record. The vertical lines divide each record into thirds. The Z on two records show the spot where B2 began pausing in responding after the delivery of 6 and 5 token reinforcers.

higher rates of correct responses and lower rates of error responses for flashcards with the tutor who had worked during the baseline phase and used the FI 90 sec Soc schedule. (See figures 10 and 11.) For reading, while there were higher rates of correct responses, there were also higher rates of errors under the same schedule conditions, rather than under the VR 3 HiSoc schedule.

Social behaviors

During Subexperiment IIA for child B2, three categories of the child's social behaviors were recorded by the tutor and an observer. The data on these behaviors are not reported because of the low reliabilities. These reliabilities are shown in Table 5.

Near the end of Subexperiment IIA it was noted that when child B2 made an error, he would frequently slap at his forehead and groan loudly such phrases as "Ooh! I knew that one," "Boy, I can't remember it!" or "Don't tell me!" These responses were counted during the last 4 sessions and they occurred only in the two sessions when B2 worked under the FI 300 sec Soc schedule, with four responses occurring in one session and 43 responses occurring in the other. There no further occurrences of these behaviors by B2 in any other experiment.

In the baseline phase of Subexperiment IIB with B2, observations and data showed that B2 frequently disrupted the writing exercises. When there was a disturbance, his writing performance was very crude with heavy lines and very large letters. He scratched through many words and wrote all over the page. Several times he refused to finish the work. He returned to his classroom twice but each time he came back to the program the next day. These disturbances occurred four times with one tutor and three times with the other.

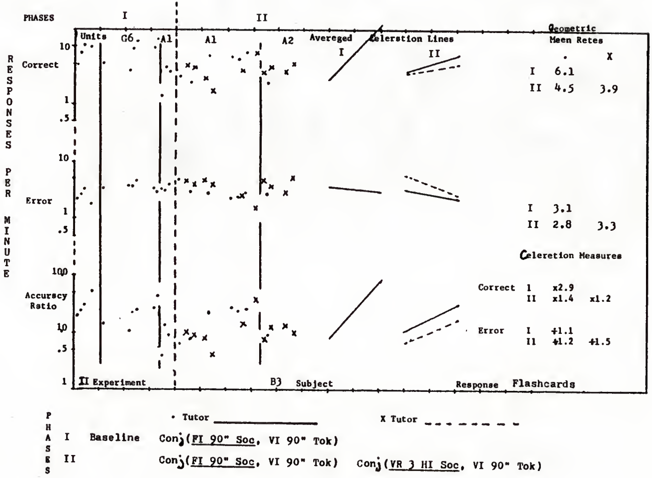


Figure 10. Flashcard performance of child B3 in Experiment II.

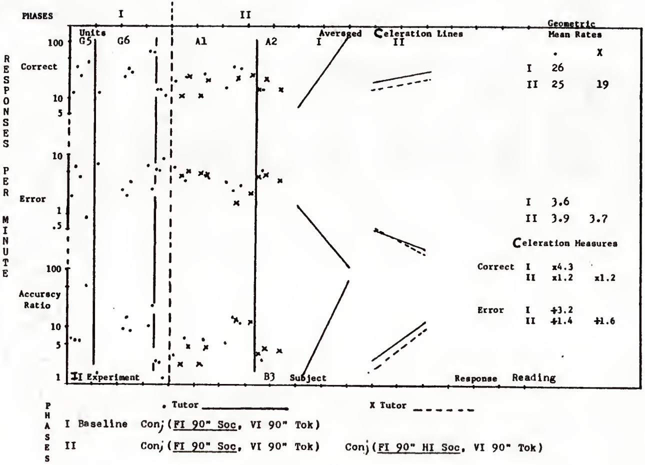


Figure 11. Reading performance of child B3 in Experiment II.

During Phase II of Subexperiment IIB, there were no occurrences of these disturbances during the writing exercises. B2 finished all the writing exercises with his average writing skills.

During Phase III, with the new tutors using the previous conjoint schedules, there were additional episodes of problem behaviors during the writing exercises. These problems occurred during 3 sessions with each of the two concurrent schedule conditions. These behaviors were less severe during Phase III than during Phase I.

Reliability measures

There was an observer for each session of Subexperiment I with B2, and for each session of a Control Study with B1. The observer independently recorded the same data that the tutors recorded. The Reliability Coefficients between the data of the observers and of the tutors are presented in Table 5. All of these reliability coefficients are the averages from all the sessions. Reliability Coefficients are reported for the social behavior data, for the error response data, and for the number of social reinforcers delivered.

Summary - Experiment II

This experiment compares the reading performances under intermittent reinforcement schedules with different frequencies of reinforcement and with different contingencies of reinforcement.

Under the FI 30 sec Soc schedule in Subexperiment IIA, B2 responded at slightly higher rates of correct and error flashcard responses. Also, there was a greater acceleration in correct flashcard response rates under this schedule. In reading, B2 responded at higher rates of correct and error responses under the alternate FI 300 sec Soc schedule.

Table 5. Reliability Coefficients Between The Tutors and Observers

Behaviors	Reliability Coefficients B2	B1
Talking out	.77	.62
Looking away	.62	.76
Negative comments	.62	.89
Head-slapping self	.89	--
Error Responses		
Reading	.92	.93
Flashcards	.96	.97
Social Reinforcers		
Delivered	.91	.94

For both reading and flashcard, there was a better acceleration in the accuracy ratios of B2 under the FI 30 sec Soc schedule.

Relative Mean Response Rates
Child B2

Subexperiment IIA	FI 30 sec Soc	FI 300 sec Soc
Flashcards		
Correct	Higher	
Error	Higher	
Reading		
Correct		Higher
Error		Higher

During Phase II in Subexperiment IIB, B2 responded at a higher rate of correct and error responses for flashcards and reading under the FI 90 sec Tok schedule. Under the FR 6 Tok schedule there was a deceleration in correct flashcard response rates and an acceleration in error response rates. During Phase III, there were few consistent differences in the responding under the two schedules.

Relative Mean Response Rates
Child B2

Subexperiment IIB
Phase II

Flashcards	FR 6 Tok	FI 90 sec Tok
Correct		Higher
Error		Higher
Reading	FR 15 Tok	FI 90 sec Tok
Correct		Higher
Error		Higher

Relative Mean Response Rates
Child B2
(Continued)

Subexperiment IIB Phase III New Tutors	FR 6 Tok	FI 90 sec Tok
Flashcards		
Correct		Higher
Error	Same	Same
	FR 15 Tok	FI 90 sec Tok
Reading		
Correct	Same	Same
Error	Higher	

The cumulative records from Phases II and III of Subexperiment IIB show that B2 developed different patterns of flashcard responding under the FI 90 sec Tok and the FR 6 Tok schedule. On the FI 90 sec Tok schedule, B2 responded at moderate rates with short pauses throughout the flashcard period. On the FR 6 Tok schedule, B2 responded at higher rates at the beginning of the flashcard period but there were long pauses in responding at the end of the flashcard period.

During the baseline condition, B3 worked with one tutor and the FI 90 sec Soc schedule. During Phase II, with the VR 3 HiSoc schedule alternating with the initial schedule, B3 responded at higher rates of correct responses for reading and flashcards with the initial tutor and schedule.

Relative Mean Response Rates
Child B3

	FI 90 sec Soc	VR 3 HiSoc
Flashcards		
Correct	Higher	
Error		Higher
	FI 90 sec Soc	FI 90 sec HiSoc
Reading		
Correct	Higher	
Error	Higher	

Near the end of Subexperiment IIA, B2 began slapping his forehead and groaning when he didn't give an answer. He did this only with the FI 300 sec Soc schedule and not with the FI 30 sec Soc schedule.

In Staats, Finley, Minke and Wolf (1964), when two intermittent reinforcement schedules were compared, there were no differences in the reading rates for the schedules. In this experiment, although there were few differences in the rates of responding that were related to the intermittent schedules, the data revealed that there were other differences in the performances of the children.

Experiment III

Experiment III compared the effects of delivering social reinforcements for correct responses with delivering either social reinforcement or disapproving social comments for error responses (see Appendix B for description of social reinforcements).

Social reinforcers delivered after correct responses were compared with social reinforcers following error responses with children B3 and B1. Social reinforcers delivered after correct responses were compared with disapproving social comments following error responses with children B5 and B1.

Social Reinforcement for Correct and Error Responses

Child B3

One tutor for B3 delivered social reinforcers for correct responses and the alternate tutor delivered social reinforcers for error responses. Both tutors used the same token reinforcement schedule for correct responses during each task. The first tutor delivered the social reinforcers on a VI 60 sec Soc Cor schedule for flashcards and reading responses. The alternate tutor delivered the social reinforcers on a VI 60 sec Soc Err schedule for the flashcard and reading responses. For Phase II, the tutors reversed schedules midway through the experiment (see Contingency Chart 4).

Child B1

Child B1 was first exposed to the contingencies that delivered social disapproval after error responses and then to the contingencies that delivered social reinforcement after error responses. The experimental procedures for both sets of contingencies are described later.

Contingency Chart 4

SUBJECT B3

Phase	Tutor	Flashcards and Reading	No. of Sessions
I. Baseline	A	Conj (VI 60 sec Soc Cor, FI 90 sec Tok Cor)	5
	B	Conj (VI 60 sec Soc Err, FI 90 sec Tok Cor)	7
II. Reversal	A	Conj (VI 60 sec Soc Err, FI 90 sec Tok Cor)	11
	B	Conj (VI 60 sec Soc Cor, FI 90 sec Tok Cor)	10

Social Reinforcement for Correct Responses and Social Disapproval for Error Responses

Child B5

One tutor delivered social reinforcers after the correct responses of B5 and an alternate tutor delivered disapproving social comments after the error responses of B5 during flashcards and reading. Both tutors delivered token reinforcements for correct responses as part of the conjoint reinforcement schedules.

During the baseline phase, child B5 worked with only one tutor who delivered the social reinforcer for correct responses on a VI 90 sec Soc Cor schedule. During Phase II, the alternate tutor delivered disapproving social comments after error responses on a VI 90 sec Dis Err schedule.

During Phase III, two new tutors worked with B5, one delivered disapproving social comments after error responses on a VI 60 sec Dis Err schedule. The second tutor delivered social reinforcers after correct responses on a VI 60 sec Soc Cor schedule (see Contingency Chart 5).

Child B1

During the baseline phase I, B1 worked with only one tutor who delivered social reinforcers after correct responses on a VI 60 sec Soc Cor schedule for flashcard and reading responses. During Phase II, an alternate tutor delivered disapproving social comments after error responses on a VI 60 sec Dis Err schedule for the flashcard and reading responses. The first tutor continued to employ his original schedule with B1. Token reinforcements were delivered after correct responses on the FI 90 sec Tok Cor schedule by all tutors throughout this study (see Contingency Chart 6).

Contingency Chart 5

SUBJECT B5

Phase	Tutor	Flashcards and Reading	No. of Sessions
I. Baseline	A	Conj (VI 90 sec Soc Cor, FI 90 sec Tok Cor)	5
II.	A	Conj (VI 90 sec Soc Cor, FI 90 sec Tok Cor)	11
	B	Conj (VI 90 sec Dis Err, FI 90 sec Tok Cor)	10
III.	C	Conj (VI 60 sec Soc Cor, FI 90 sec Tok Cor)	12
	D	Conj (VI 60 sec Dis Err, FI 90 sec Tok Cor)	12

Contingency Chart 6

SUBJECT B1

Phase				
I. Baseline	A	Conj	(VI 60 sec Soc Cor, FI 90 sec Tok Cor)	13
II.	A	Conj	(VI 60 sec Soc Cor, FI 90 sec Tok Cor)	5
	B	Conj	(VI 60 sec Dis Err, FI 90 sec Tok Cor)	4
III.	A	Conj	(VI 60 sec Soc Cor, FI 90 sec Tok Cor)	6
	B	Conj	(VI 60 sec Soc Err, FI 90 sec Tok Cor)	6
IV. New Tutors	C	Conj	(VI 60 sec Soc Cor, FI 90 sec Tok Cor)	5
	D	Conj	(VI 60 sec Soc Err, FI 90 sec Tok Cor)	6
V. Reversal	C	Conj	(VI 60 sec Soc Err, FI 90 sec Tok Cor)	10
	D	Conj	(VI 60 sec Soc Cor, FI 90 sec Tok Cor)	10

After 8 sessions in Phase II, Phase III was started so that the alternate tutor delivered social reinforcers after error responses on the VI 60 sec Soc Err schedule for the flashcard and reading responses.

During Phase IV, the last schedules from the previous phase were continued but with new tutors administering the schedules. One tutor delivered the social reinforcers on a VI 60 sec Soc Err schedule. The alternate tutor delivered the social reinforcers on a VI 60 sec Soc Cor. Midway through the term the tutors and reinforcement schedules were reversed for Phase V.

Results - Experiment III

This experiment compared the effects of schedules that delivered social reinforcement after correct responses with schedules that delivered either social reinforcers or disapproving social comments after error responses.

Comparisons between social reinforcement after correct responses and social reinforcement after error responses were made with child B3 and with several experimental phases of B1.

Comparisons between social reinforcement after correct responses and disapproving social comments after error responses were made with child B5 and with one experimental phase with B1.

Social Reinforcement for Correct and Error Responses

Child B3

During the initial phase of the flashcard performance, B3 responded at a slightly greater rate of correct responses, 4.6 and 4.2 responses per minute, and a greater acceleration in the rate of correct responses, x 1.8 and x 1.2 responses per minute per week, on the schedule

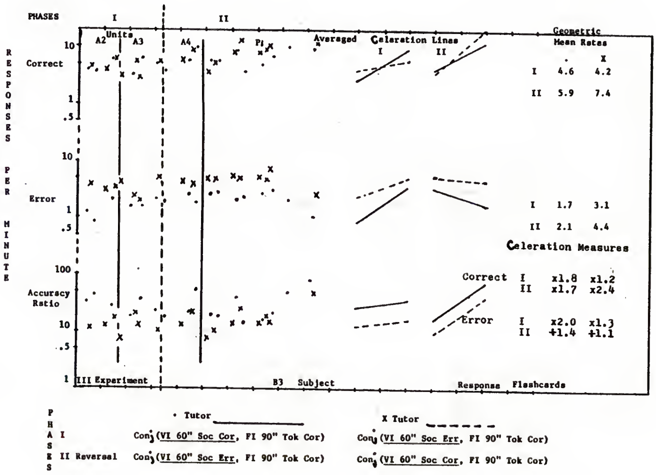


Figure 12. Flashcard performance of child B3 in Experiment III.

for correct responses, *VI 60 sec Soc Cor* than on *VI 60 sec Soc Err*, figure 12. For error responses, there was a higher rate of error responses on the *VI 60 sec Soc Err* schedule than on the *VI 60 sec Soc Cor* schedule, 3.1 error responses and 1.7 error responses per minute, respectively. Additionally, there was a greater accuracy ratio on the schedule that reinforced error responses.

During the reversal phase when the tutors exchanged reinforcement schedules, the responding of B3 maintained the relationship between the reinforcement schedule and the correct flashcard response rates. During the reversal phase, there were again greater rates of correct responses, 7.4 and 5.9 responses per minute, respectively, on the *VI 60 sec Soc Cor* schedule than on the *VI 60 sec Soc Err* schedule. This reversal was also evident for the correct acceleration measures, x 2.4 and x 1.7 responses per minute per week for the same respective schedules.

With the flashcard error performances, B3's error response rates did not maintain the same relationship to the reinforcement conditions. B3 continued to respond at higher rates of error responses with the tutor who used the *VI 60 sec Soc Err* schedule in Phase I but used the *VI 60 sec Soc Cor* schedule in Phase II. In Phase II, there was an error response rate of 2.2 responses per minute on the *VI 60 sec Soc Cor* schedule.

For the reading performances, B3 responded at higher overall correct and error response rates with the tutor who employed the *VI 60 sec Soc Err* schedule for the intial phase. B3 continued to respond at higher overall correct and error response rates with this tutor in the reversal phase even though he used the alternate schedule, *VI 60 sec Soc Cor*

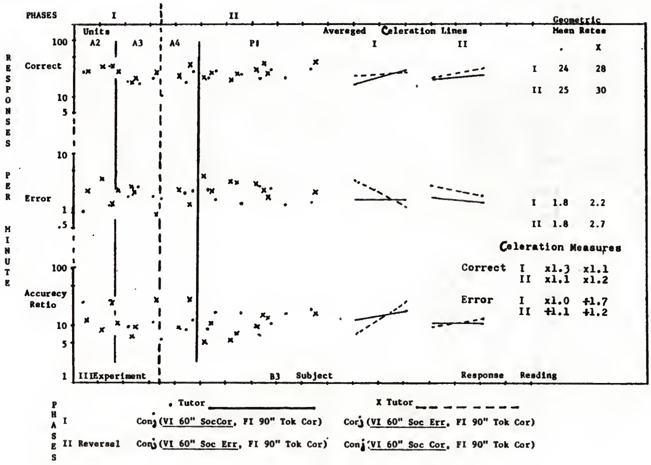


Figure 13. Reading performance of child B3 in Experiment III.

(figure 13). However, there was a greater acceleration in the correct reading response rates in both the initial phase, x 1.3 and x 1.1 responses per minute per week, and the reversal phase, x 1.2 and x 1.1 responses per minute per week, on the VI 60 sec Soc Cor schedule than on the VI 60 sec Soc Err schedule.

Child B1

During the baseline phase with only the VI 60 sec Soc Cor schedule, there was an acceleration in correct response rates and a deceleration in error response rates for both reading and flashcard performances, figures 14, 15. In Phase II, when the VI 60 sec Dis Err schedule was introduced, B1's performance for the new schedule was markedly different from his continuing performance with the first schedule. With the new schedule, there was a sharp increase in the acceleration for correct flashcard response rates, x 10.5 responses per minute per week, with a deceleration in error response rates, ÷ 6.0 responses per minute per week, which in combination produced a very high acceleration in the accuracy ratio. With this new schedule, B1 responded at higher rates of correct and error flashcard responses than on the baseline schedule.

In contrast to the improvement in flashcards, B1's reading performance with the new schedule, VI 60 sec Dis Err, showed a deterioration; there was a deceleration in the rates of correct reading responses, ÷ 2.0 responses per minute per week on the new schedule. However, he responded at higher overall rates of correct and error reading responses on this schedule. (These flashcard and reading celeration lines should be considered with caution for they were computed from 2 curriculum phases that had only 2 data points each for each schedule, figure 15. This is a

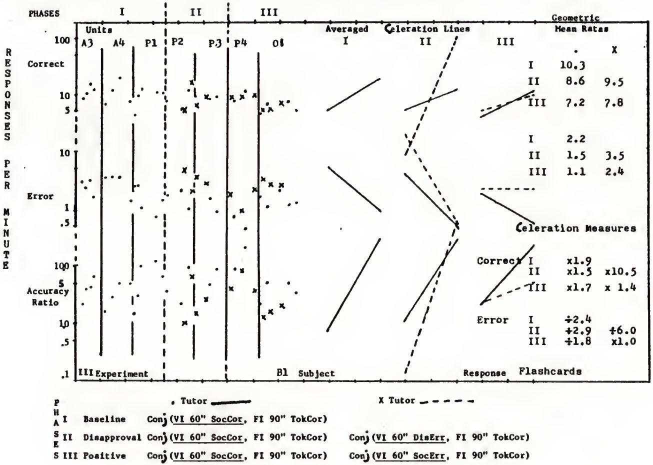


Figure 14. Flashcard performance of child B1 in Experiment III.

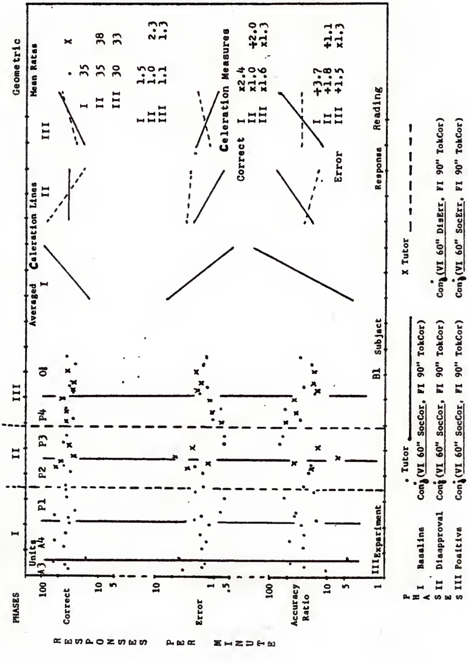


Figure 15. Reading performance of child B1 in Experiment III.

departure from the aforementioned convention of computing celeration lines only for phases that had at least 3 data points for each schedule condition.)

Phase II was terminated abruptly because B2 reacted severely to the disapproving comments. During this phase, he held his stomach and complained of feeling bad during two different sessions with the positively reinforcing VI 60 sec Soc Cor schedule. At the beginning of his fifth session with the VI 60 sec Dis Err schedule, B1 complained of being sick and became very distraught. He was assured that he did not have to work if he did not want to and he was counseled at length before returning to his classroom. Following this episode, Phase II was terminated.

In Phase III, the formerly disapproving tutor employed the VI 60 sec Soc Err schedule. With this tutor and schedule, B1 continued to respond at higher rates of correct and error responses in flashcards and reading. But B1 had greater accelerations of correct responses and greater decelerations of error responses for both flashcards and reading with the initial tutor and the VI 60 sec Soc Cor schedule.

During Phases IV and V, B1 worked with two new tutors who used the same VI 60 sec Soc Err and VI 60 sec Soc Cor schedules as in Phase III. For the flashcard performances in Phase IV, B1 responded at higher overall rates of correct and error responses on the VI 60 sec Soc Err schedules. Additionally, there was a greater acceleration in correct responses and a lower acceleration in error responses on this schedule.

During Phase V when the tutors and the reinforcement schedules were reversed, there was a reversal in the rates of flashcard responses and in the acceleration lines. B1 responded at higher correct and error response rates and there was a greater acceleration in correct responses

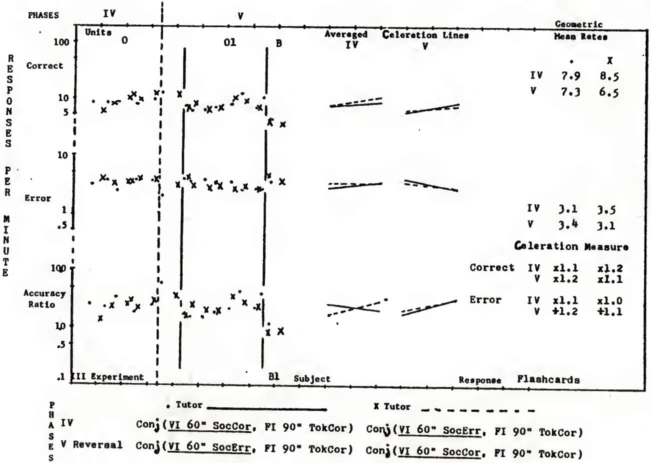


Figure 16. Flashcard performance of child B1 in Experiment III.

and a greater deceleration in error responses with the same VI 60 sec Soc Err schedule (figure 16).

For the reading performances in Phase IV, B1 responded at higher rates of correct and error responses for the schedule which reinforced errors, VI 60 sec Soc Err (figure 17). But there was a greater acceleration for correct responses, x 1.2 responses per minute per week, for the schedule which reinforced correct responses, VI 60 sec Soc Cor.

When the tutors and the reinforcement schedules were reversed in Phase V, B1 responded at equal reading rates of correct and error responses with both schedules. There was a slight acceleration x 1.1 responses per minute per week, in the error response rate with the schedule for correct responses VI 60 sec Soc Cor.

Subject B5

During the baseline phase with only the VI 90 sec Soc Cor schedule, B5 responded at rates of 14.0 and 2.7 responses per minute for the correct and error flashcard responses. There were celerations of x 1.5 and ÷ 1.3 responses per minute per week for the rates of correct and error flashcard responses, figure 18.

In Phase II, the VI 90 sec Dis Err schedule was started as the alternate schedule. In this phase, B5 responded at higher correct flashcard response rates under the VI 90 sec Soc Cor schedule than under the new schedule, 9.6 and 8.4 responses per minute, respectively. For error responses, there were higher error response rates with the VI 90 sec Soc Cor schedules, 2.7 and 1.8 responses per minute, than for the new schedule. There was a greater deceleration in error response rates with the VI 90 sec Soc Cor schedule than the VI 90 sec Dis Err

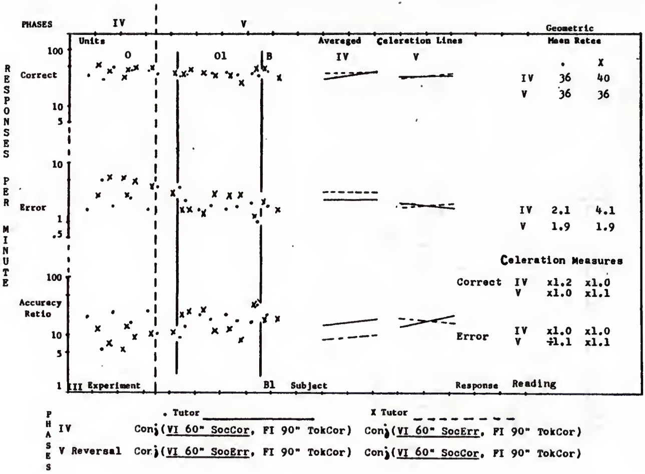


Figure 17. Reading performance of child B1 in Experiment III.

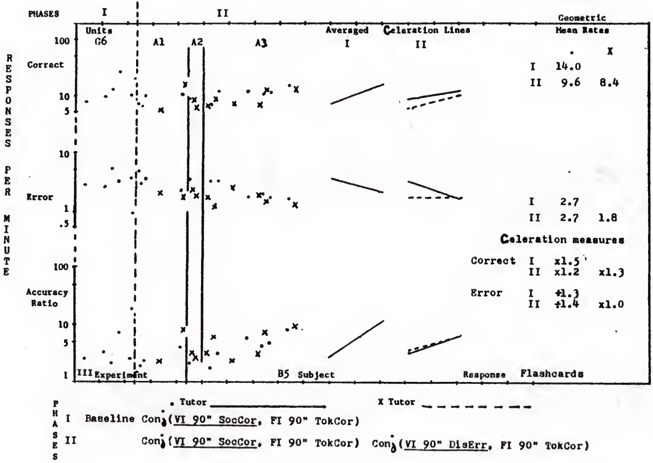


Figure 18. Flashcard performance of child B5 in Experiment III.

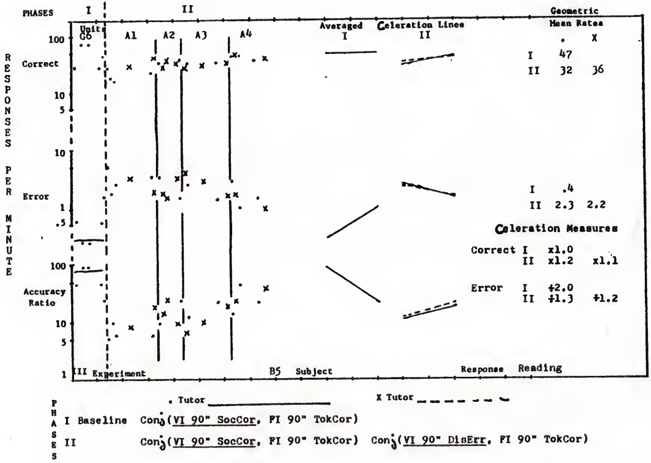


Figure 19. Reading performance of child B5 in Experiment III.

schedule, ÷ 1.4 and x 1.0 responses per minute per week, respectively.

In the baseline phase with reading, B5 responded at a high stable rate of correct responses, 47.0 responses per minute, figure 19. He made no errors for the reading exercise during the first two sessions. After these sessions without errors, there was an increase in the occurrence of error responses and thus an acceleration, x 2.0 responses per minute per week, in the error response rate. In Phase II, there were higher correct response rates and lower error response rates, 36 and 2.2 responses per minute, with the VI 90 sec Dis Err schedule than with the VI 90 sec Soc Cor schedule, 32 and 2.3 responses per minute. The Celeration Measures for the correct and error responses were similar for both schedules.

For Phase III, B5 worked with two new tutors but they used the same reinforcement schedules as in Phase II. For flashcards and reading, B5 responded at higher rates of correct and error responses for the schedule that delivered positive reinforcement after correct responses, FI 90 sec Soc Cor than for the disapproval for error schedule FI 90 sec Dis Err, figures 20, 21. There was a lower rate of error responses on the disapproval schedule, but there was a greater deceleration of error response rates for the VI 60 sec Soc Cor schedule.

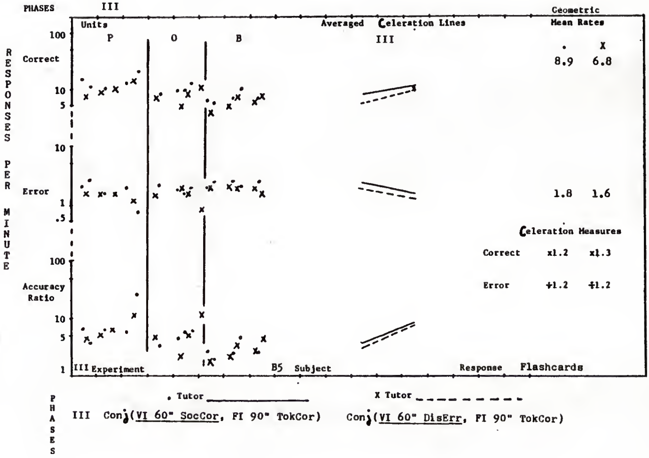


Figure 20. Flashcard performance of child B5 in Experiment III.

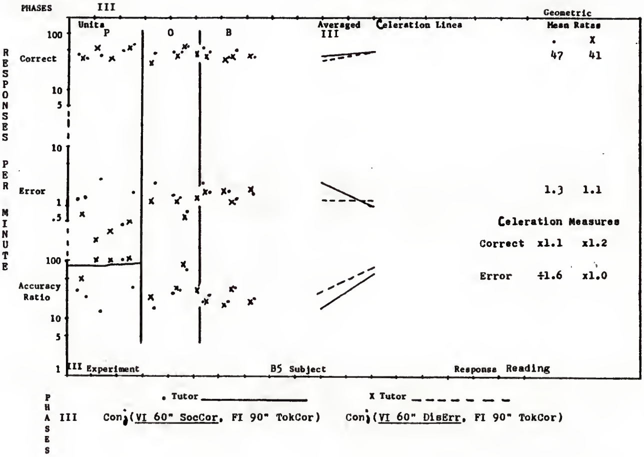


Figure 21. Reading performance of child B5 in Experiment III.

Summary - Experiment III

The studies in this experiment showed that the reinforcement schedules which delivered social reinforcements after either correct or error responses differentially affected the rates of those responses.

Social reinforcement after correct and error responses

B3 responded at greater rates of correct responses during both phases for flashcards and during the second phase for reading under the VI 60 sec Soc Cor schedule. This relationship between correct response rates and the reinforcement schedule continued in flashcards when the tutors and reinforcement schedules were reversed in Phase II. Additionally, there was a greater acceleration in the correct rates for reading and flashcards in the initial and the reversal phase on this same schedule.

Relative Mean Response Rates
Child B3

	VI 60 sec Soc Cor	VI 60 sec Soc Err
Flashcards		
Correct	Higher	
Error		Higher
Reversal		
Correct	Higher	
Error	Higher	
Reading		
Correct		Higher
Error		Higher

Relative Mean Response Rates
Child B3
(Continued)

	VI 60 sec Soc Cor	VI 60 sec Soc Err
Reversal		
Correct	Higher	
Error	Higher	

B3 responded at higher rates of error responses for both the reading and flashcard performances with the tutor who initially employed the VI 60 sec Soc Err schedule. This relationship remained tutor-related when the contingencies were reversed with the tutors.

B1 responded at higher rates of correct and error responses in flashcards and reading under the FI 60 sec Soc Err schedule for two different sets of tutors. When the tutors and reinforcement schedules were reversed, this relationship between the response rates and the reinforcement schedule remained. B1 was the only child who did not respond at a higher correct response rate under the schedule that reinforced correct responses. However, this child had a severe reaction to an earlier reinforcement schedule that delivered disapproving comments for error responses.

Relative Mean Response Rates
Child B1

	VI 60 sec Soc Cor	VI 60 sec Soc Err
Flashcards Phase III		
Correct		Higher
Error		Higher
Reading		
Correct		Higher
Error		Higher

Relative Mean Response Rates
Child B1
(Continued)

	VI 60 sec Soc Cor	VI 60 sec Soc Err
New Tutors Flashcards Phase IV		
Correct		Higher
Error		Higher
Reversal Phase V		
Correct		Higher
Error		Higher
Reading Phase IV		
Correct		Higher
Error		Higher
Reversal Phase V		
Correct	Same	Same
Error	Same	Same

Social reinforcement for correct responses and disapproval for error responses

B5 responded at higher rates of correct responses with the VI 90 sec Soc Cor schedule for flashcards during both phases and for reading during the second phase. Error response rates were lower during both experimental phases for reading and flashcards on the VI 90 sec Dis Err schedule.

Relative Mean Response Rates
Child B5

	VI 90 sec Soc Cor	VI 90 sec Dis Err
Flashcards		
Correct	Higher	
Error	Higher	
Reading		
Correct		Higher
Error	Higher	
New Tutor Flashcards		
Correct	Higher	
Error	Higher	
Reading		
Correct	Higher	
Error	Higher	

B1 responded at higher rates of correct and error responses for both reading and flashcards on the VI 60 sec Dis Err schedule. B1 became very anxious and distraught during this phase and the phase had to be terminated abruptly because of his severe reaction.

Relative Mean Response Rates
Child B1

	VI 60 sec Soc Cor	VI 60 sec Dis Err
Flashcards Phase II		
Correct		Higher
Error		Higher
Reading		
Correct		Higher
Error		Higher

Under the schedules that reinforced correct responses, there were higher correct reading and flashcard response rates for children B3 and

B5. For these two children, the relationship between the correct response rate and the reinforcement schedules remained both when the tutors and reinforcement schedules were reversed and when new tutors used the same schedules. The third child, B1, did not respond at higher rates of correct responses for the schedule that reinforced correct responses.

Under the schedules that reinforced error responses, there were higher rates of reading and flashcard error responses for chidren B3 and B1. This relationship did not remain for B3 or for the reading error responses of B1 when the tutors and reinforcement schedules were reversed. The relationship did remain during the reversal phase for the flashcard error responses of B1.

Under the schedule that delivered disapproving comments after error responses, there were lower error response rates for reading and flashcards for two sets of tutors with child B5. A second child, B1, responded at higher error response rates for the tutor who responded to errors, both when the tutor was delivering disapproving comments and when he was delivering social reinforcements after error responses. However, the error response rate of B1 decelerated during the condition of delivering disapproving comments and accelerated during the condition of delivering social reinforcers.

Experiment IV

Experiment IV compared the effects of a Conjoint schedule that reinforced correct responses and a Tandem schedule that reinforced a sequence of error and correct responses. The sequences of error responses were recorded and analyzed as separate response units. Therefore, the effects of the reinforcers could be determined not only by comparing the rate data of individual responses but also by analyzing the occurrences of the sequences of error responses.

On the Tandem schedule, the social and token reinforcers were delivered for a specific sequence of error and correct flashcard responses. The schedule was a Tandem Brief-Stimulus (FR 3 Soc Err, CRF Tok Cor) schedule. In the initial component, a social comment was delivered following 3 consecutive error responses. Then, during the second component, a token reinforcer was delivered after the first correct response. Under this schedule, no token could be delivered for correct responses until the subject had made three consecutive error responses and had received the social reinforcer at the completion of the first component. In the second component, the token was delivered after the first correct response regardless of what errors were made. The delivery of the token terminated the second component and the schedule started over.

The alternate tutor used a Conj (VI 90 sec Soc Cor, FR 6 Tok Cor) schedule for the flashcard responses (see Contingency Chart 7). The children in this experiment were G1 and B6. For child G1, the rein-

Contingency Chart 7

EXPERIMENT 4

	Tutor	Flashcards	No. of Sessions
Child B6	A	Tandem (FR 3 Soc Err, CRF Tok Cor)	14
	B	Conj (VI 90 sec Soc Cor, FR 6 Tok Cor)	15
Child G1			
I.	A	Tandum (FR 3 Soc Err, CRF Tok Cor)	10
	B	Conj (VI 90 sec Soc Cor, FR 6 Tok Cor)	9
II. Reversal	A	Conj (VI 90 sec Soc Cor, FR 6 Tok Cor)	7
	B	Tandem (FR 3 Soc Err, CRF Tok Cor)	5

forcement contingencies and tutors were reversed for Phase II.

The tutors recorded the sequences of error responses and computed the conditional probabilities for short sequences of error responses using the techniques described in Chapter III.

Results - Experiment IV

Child G1

Figure 22 shows that for the flashcard performances, G1 responded at slightly higher correct response rates, 8.1 and 7.5 responses per minute and lower error response rates, 3.2 and 3.9 responses per minute, with the Conjoint schedule than the Tandem schedule in the initial phase. During the Phase II reversal, G1 continued to respond at higher correct response rates with the Conjoint schedule even though the alternate tutor used the schedule. The error response rates, however, did not follow the schedule change but continued to be related to the tutor.

During Phase I, there was a greater acceleration in correct responses, x 1.2 and x 1.1 responses per minute per week, and a greater deceleration in error responses, ÷ 1.3 and x 1.0 responses per minute per week, for the Conjoint schedule than for the Tandem schedule. In the reversal phase, G1 did not have a reversal in the celeration measures; she continued to have a greater deceleration in error responses with the same tutor even though that tutor used the Tandem schedule in Phase II.

Child B6

B6 responded at slightly higher correct and error flashcard response rates on the Tandem schedule. (See figure 23.) There were

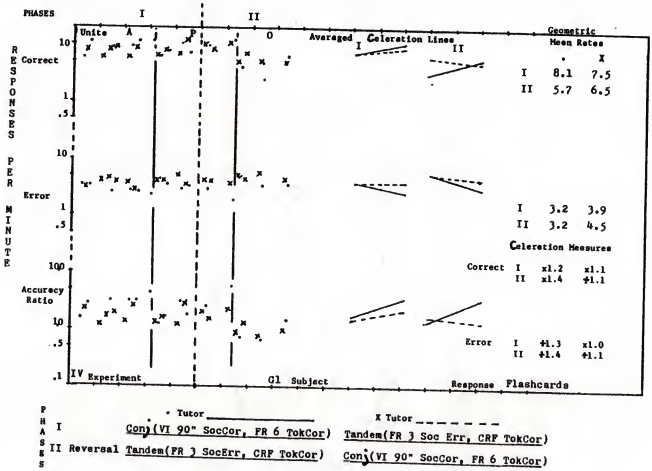


Figure 22. Flashcard performance of child G1 in Experiment IV.

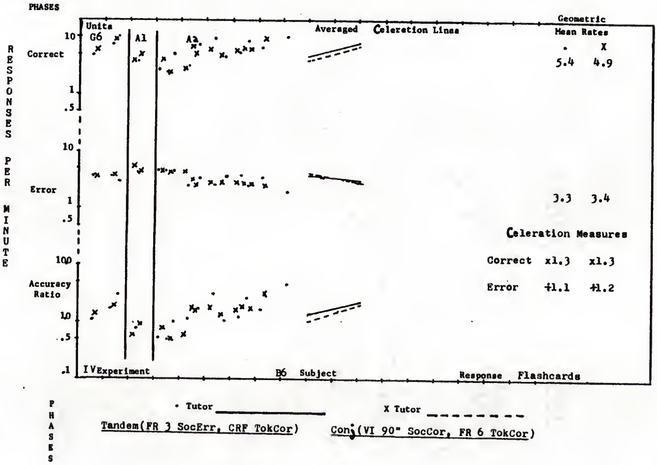


Figure 23. Flashcard performance of child B6 in Experiment IV.

higher rates of correct responses and error responses on this schedule, 5.4 and 3.4 responses per minute, respectively, than on the Conjoint schedule, 4.9 and 3.2 responses per minute, respectively.

Pattern data

The conditional probabilities of the lengths of sequences of successive flashcard error responses were computed for the Tandem schedule and the Conjoint schedule.

Table 6 shows the conditional probabilities of short sequences of error responses for children G1 and B6. The two columns of numbers correspond to the Conjoint and Tamdem reinforcement schedules. The top section of the table shows the conditional probabilities for child G1, arranged in relation to the two phases of the experiment. The middle section shows the same conditional probabilities for child G1 but arranged in relation to the two tutors in the experiment. The bottom section shows the conditional probabilities for child B6.

Table 6 shows that G1 and B6 responded with different patterns of error sequences for the Conjoint and Tandem reinforcement schedules. There were greater conditional probabilities of short sequences of 2 error responses with the Conjoint schedule of reinforcement than with the Tandem schedule for the comparisons in all three sections of the Table.

These data indicate than when the tutors and the reinforcement conditions were reversed for G1, the relationship between the reinforcement conditions and the conditional probabilities continued. However, figure 22 shows that the rate data for the error responses continued to be related to the tutors after the reversal.

Table 6. Conditional Probabilities of Short Sequences of Error Responses

	Conjoint -	Tandem Schedules
Child G1		
Phase I	.65	.48
Phase II	.54	.50
Tutor A	.65	.50
Tutor B	.54	.48
Child B6	.54	.50

Short Sequences are 2 Errors in Row

Summary - Experiment IV

G1 responded at higher correct response rates in both phases under the Conjoint schedule which reinforced correct responses. This relationship between the correct response rates and the reinforcement schedule remained when the reinforcement schedules and tutors were reversed. There was a greater rate of error responses with the tutor who initially reinforced error responses on the Tandem schedule, and this relationship remained tutor-related when the contingencies were reversed.

The patterns of sequences of correct and error flashcard responses of G1 were different for the Conjoint and Tandem reinforcement schedules. In both phases, there was a greater conditional probability of short sequences of error responses with the Conjoint schedules. These patterns of responses remained related to the reinforcement contingencies when the tutors and the reinforcement contingencies were reversed. For each comparison between the Conjoint and Tandem schedules, the relationship between the patterns of error responding and reinforcement contingencies remained.

Relative Mean Response Rates

	Tandum	Conjoint
Child G1		
Correct		Higher
Error	Higher	

Relative Mean Response Rates
(Continued)

	Tandem	Conjoint
Child G1		
Reversal		
Correct		Higher
Error		Higher
Child B6		
Correct	Higher	
Error	Higher	

Child B6 responded at slightly higher correct response rates on the Tandem schedule. Additionally, there were higher error response rates under the Tandem schedule.

Although child B6 responded at slightly different rates for the Conjoint and Tandem schedules, his patterns of error responses were clearly different for each schedule. There was a greater conditional probability of short sequences of error responses with the Conjoint schedule. This pattern of responding was similar to the performance of subject G1.

For correct responding, the results from the two children conflict. For G1, the correct response rates were higher under the Conjoint schedule and this relationship remained after the reversal. For B6, the correct response rates were higher under the Tandem schedule. For error responding, both children responded at higher error response rates under the Tandem schedule. This relationship did not remain during the reversal phase for G1.

The patterns of sequences of error responses were similar for both children. There were greater conditional probabilities of short sequences of error responses under the Conjoint schedule. This relationship remained during the reversal phase for G1.

CHAPTER V
DISCUSSION

The four experiments progressively examine the effects of different reinforcement contingencies on reading behaviors to determine the functional significance of the social reinforcers. Experiments I and II examine the effects of the social reinforcers delivered on different intermittent reinforcement schedules. Experiments III and IV compare the effects of delivering social reinforcers and disapproving comments for two incompatible responses, correct and error responses.

The findings of the four experiments are summarized in relation to the three areas of data:

1. The Rate Data of the correct and error responses
2. The Pattern Data of the correct and error responses
3. The Social Behavior that the children emitted during the experiments

The results are then discussed in relation to the function of the social comments as reinforcers, and in relation to the effects of the reinforcement schedule variables. The academic performances of the children and the curriculum program are then discussed. Finally, directions for further research are suggested.

Rate Data

This section summarizes the results of the rate data of the four experiments. The findings are then discussed in relation to the effectiveness and function of the social reinforcement used in these experiments.

There were conflicting results for the comparisons in Experiment I between a social reinforcement schedule VR 3 Soc and a no-social reinforcement schedule, Ext Soc. Child G1 responded at higher rates of correct and error responses on the Ext Soc schedule, but the accuracy ratios on the Ext Soc schedule and the VR 3 Soc schedule were equivalent. Thus, the social reinforcer seemed to disrupt the performance of child G1 so that she responded at lower rates on the VR 3 Soc schedule, but with equivalent accuracy. However, child B4 responded at slightly higher rates for correct responses with better acceleration measures, and better accuracy ratios for the VR 3 Soc schedule for two terms in the experiment. For child B4, the differential increase in the correct response rates indicates that the social comments functioned as reinforcements for his correct responding.

Stevenson and Snyder (1960) compared the effects of sequential periods of token reinforcement and nonreinforcement with a marble dropping response. The highest rates of responding occurred during two successive periods of nonreinforcement, and the next highest rates occurred during two successive periods of reinforcement. Lower rates occurred when the child was exposed to both a reinforcement and a nonreinforcement period. They reported that the reinforcement appeared to initially distract the child.

There were few consistent differences in the responding for the different intermittent reinforcement schedules in Experiment II. Child B2 responded at higher rates in flashcards under the FI 30 sec Soc schedule but he responded at higher rates in reading under the FI 300 sec Soc schedule. There were greater accuracy ratios for reading and flashcards under the FI 30 sec Soc schedule.

In Subexperiment II B, child B2 responded at greater rates of correct responses in reading and flashcards for the FI 90 sec Tok schedule than for the FR 6 Tok schedule. These results are opposite from the findings reported in the literature for FI and FR schedules with similar reinforcement frequencies. These findings are discussed further in the Pattern Data section.

Two magnitudes of social reinforcement were compared with child B3. However, this child responded at higher rates with his first tutor, with whom he had worked alone for three weeks, even though the second tutor used the higher magnitude of social reinforcement.

The rate data from Experiments I and II do not show consistent effects of the intermittent reinforcement schedules. When two different intermittent reinforcement schedules were compared,the results were conflicting. There were conflicts between the results for flashcards and the results for reading for the same subject or between the results for one subject and the results for a second subject under the same schedule. When there were consistent rate data results in these experiments, the results were attributable to factors other than the reinforcement schedules, e.g., the length of time the child had worked with a tutor.

The rate data from Experiments III and IV show consistent effects of the social reinforcement contingencies on correct and error responses. Social reinforcement after correct responses was associated with higher correct flashcard and reading response rates for children B3 and B5 in Experiment III and for child G1 in Experiment IV. This relationship continued through reversal manipulations for children B3 and G1 and it was replicated with two sets of tutors for child B5. This relationship did not develop for child B1. However, child B1 had a severe reaction to a previous reinforcement schedule, and his performance was exceptional in several ways.

Social reinforcement after error responses was associated with higher error flashcard and reading response rates for children B3 and B1 in Experiment III and G1 and B6 in Experiment IV. This relationship did not continue through reversal manipulations for children B3, G1, or for the reading error responses of B1. For the flashcard error responses of child B1, the relationship did remain through the reversal manipulation. Thus, the error response rates were initially sensitive to the social reinforcement that the tutors differentially provided. However, when the tutors changed the contingencies, the children did not change their relative rates of error responding.

Disapproving comments after error responses were associated with lower flashcard and reading error response rates for child B5 and this relationship was replicated in a second set of tutors for child B5. Child B1 responded at higher error response rates under this condition. However, he had a severe reaction to this schedule and the phase had to be terminated abruptly.

When the contingencies for a child were reversed between the tutors, the correct response rates reversed and remained contingency-related every time, but the error response rates usually did not reverse but remained tutor-related. The error response rates reversed only for flashcard responses with child B1 which may show that he had a greater sensitivity to the error response contingencies.

Pattern Data

A pattern of responding exists when there is a regular and consistent relationship between each of the responses and other environmental events. A pattern may show the sequential or temporal relationships between the subject's responding and other environmental events.

The ongoing patterns of flashcard responses in these experiments were analyzed with the cumulative records of child B2 and the probability distributions of the sequences of correct and error responses with children B4, B6, and G1.

These techniques of data analysis revealed that highly consistent patterns of responding developed for each of these children with their different reinforcement schedules. When the reinforcement schedules were reversed, the patterns of responding reversed. When a new set of tutors used the previous reinforcement schedules, the previous patterns of responding were replicated.

The cumulative records of child B2 in Experiment II showed that different patterns of flashcard responding developed for the FR 6 Tok schedule and the FI 90 sec Tok schedule. On the FR 6 Tok schedule, B2 responded at a higher rate with short pauses early in the session and he responded at a lower rate with long pauses late in the session. Throughout each session on the FI 90 sec Tok schedule, B2 responded at lower sustained rates with short pauses. These patterns resemble those reported by Ferster and Skinner (1957) for the FR and FI schedules. In their studies, long pauses in FR responding developed when reinforcement was insufficient, when the deprivation level of the subject was close to normal body weight, and when certain drugs were administered.

A primary contributing factor for the long pauses in the FR responding of child B2 may have been his history from the previous term of being able to earn only 6 tokens in the flashcard drill on an FI 90 sec Tok schedule. Additionally, in the term when the present patterns developed, the schedule that alternated with the FR schedule was the FI 90 sec Tok schedule so that with that alternate schedule child B2 could earn only 6 tokens. He had earned as many as 10 tokens on the FR 6 Tok schedule but for a long period he did not obtain more than 6 or 7 tokens on the schedule. In Chart 2 , he decreased his rate of responding after obtaining his fifth or sixth token. In functional terms, it can be inferred that his flashcard responding was under the stimulus control of having earned a certain number of tokens rather than under the contingency control of being able to earn tokens throughout the flashcard drills on an FR schedule.

The probability distributions of sequences of correct and error responses were determined for the children in two experiments. In Experiment IV, both children B6 and G1 had greater conditional probabilities of long sequences of error responses on the Tandem schedule that reinforced a sequence of 3 consecutive errors with a social reinforcer.

In Experiment I, child B4 had greater frequencies of short sequences of error responses and of long sequences of correct responses on the VR 3 Soc schedule than on the Ext Soc schedule. The differences between the distribution of sequences for the VR 3 Soc and Ext Soc components were greater during the last 3 sessions of a curriculum phase.

These data measures for children B2, B4, B6, and G1 showed that distinct patterns of responding were developing for these children with the different reinforcement contingencies. Additionally, the patterns showed the interaction between the child's responding and the reinforcement contingencies.

Although these distinct patterns of responding developed, the rate measures of responding for these children showed small differences for their different contingencies. The pattern data was highly consistent, showing reversals in error patterns for child G1 when the tutors and contingencies were reversed even when the error rates did not reverse. Also, there were replications of patterns for child B2 when a new set of tutors used the same contingencies as the previous tutors. The pattern data for children B6 and G1 showed the same effect of the contingencies but the rate data for correct responding for these children were in conflict. Thus, the pattern data indicated that these children were being systematically influenced by the contingencies but the rate data did not show the influence of the contingencies, and in some cases the rate data showed some conflicting effects of the contingencies.

Social Behaviors

These experiments were interested in the effects of the reinforcement contingencies and the reading exercises on the whole behavioral repertoire of the child. Therefore, in addition to recording the reading responses, the tutors made observations and recorded other behaviors of the children. Falk, 1971, points out that reinforcement schedules for one specific response may influence the occurrence of other behaviors. These other influenced behaviors are called adjunctive behaviors. He reports that certain schedules of positive reinforcement for lever pressing with animals induced the occurrence of aggressive responses toward other animals of the same species, induced the occurrence of escape responses, and induced the occurrence of drinking responses. These adjunctive behaviors occur consistently after the delivery of reinforcement.

Initially, the tutors and observers recorded, for children B1 and B2, the occurrences of specific behaviors, i.e., irrelevant talking, turning away from work, and negative comments. Thomas et al., 1968, recorded five classes of disruptive behaviors for children in a classroom setting: gross motor, noise making, orienting, verbalizations, and aggression. The observers in that study recorded whether these behaviors occurred during successive 10-second intervals.

In the current experiment, the reliability coefficients between the tutors and observers for the behaviors of talking, turning away, and negative comments were respectively .77, .62, and .62 for child B2 and

.62, .76, and .89 for child B1. Thomas et al., 1968, reported reliability coefficients of .83 for their observers recording the occurrences of the behaviors per 10-second interval.

After recording the occurrences of the preselected responses, it was noted that for some children, a response unique to that child could be selected which might indicate the influence of the reinforcement contingencies or of the reading exercises. For several children, episodes of certain behaviors seemed to reveal the effects of the reinforcement contingencies and the reading exercises. The episodes occurred more often for one set of reinforcement contingencies or at a particular point in the reading exercises. These episodes were sometimes associated with a disruption in the academic performance of the child.

During the last four sessions of Experiment II, the tutor began recording occurrences of child B2 slapping his forehead and saying such phrases as, "Oh!, I know that one", "Boy, I can't remember it!" These behaviors occurred only in the two sessions under the FI 300 sec Soc schedule; with 4 episodes in one session and 43 in the other. No episodes of these responses were recorded in the two sessions under the FI 30 sec Soc schedule. The reliability coefficient for the head slapping response was .89 between the observer and the tutor. These social behaviors were not correlated with a disruption in the child's academic performance.

During the next two experimental terms, B2 did not emit this head slapping response again. However, during both of the terms he had several episodes of severe disruptive behaviors during the writing exercises. During these disruptive episodes, child B2 made large, crudely shaped letters, scribbled over his work, marked his work wrong, and left the room twice.

These disruptions, during the writing exercises, stopped when a phase change occurred and one tutor began delivering token reinforcers on an FR schedule during flashcards and reading. During this phase, long pauses in responding developed under the FR schedule during flashcard drills. In the final experimental phase, when new tutors employed the same FR and FI schedules, the pauses in the flashcard responding redeveloped under the FR schedule and the disruptions in writing episodes reoccurred but they were not as severe. Thus, the disruptions in the writing exercises ceased when there was a change in the reinforcement contingencies for flashcard exercise. Then, disruptions developed during the flashcard exercises. Finally, the disruptions occurred during both the flashcard and writing exercises.

During Experiment III, child B1 had a severe personal reaction to the reinforcement contingencies which delivered disapproving social comments following error responses. At the beginning of the fourth session with the disapproving tutor, child B1 complained of a stomach ache and said that he didn't want to work and that he wanted to go back to his class. B1 was very agitated but did not complain about the tutor or the tutoring conditions. In the preceding session with the alternate tutor, child B1 told the tutor he liked her and always wanted to work with her.

During this brief phase, child B1 exhibited unusual academic performance with the tutor who delivered disapproving comments after error responses. There were a sharp acceleration in correct flashcard response rates and a sharp deceleration of error flashcard response rates. This interaction provided a striking improvement in flashcard accuracy ratios. In contrast to the flashcard performance, there was a sharp deceleration in the correct reading response rates, but the reading error response rate was stable. The reading performance had a deceleration in the accuracy ratio; yet there was a greater average rate of correct reading responses under this schedule.

In the next phase, when the disapproving tutor began delivering positive social comments following error responses, child B1 no longer exhibited personal disturbances and his academic behaviors were more stable, with accelerations in the accuracy ratios for flashcards and reading.

Observations of the social and personal behaviors of the children show that the tutoring situation and the reinforcement contingencies had broad effects on the whole behavioral repertoire of the child. Analysis of the academic performances of the children generally showed a relationship between the social behaviors of the child and the reinforcement contingencies for the academic responses. Each of the social behaviors occurred several times under one reinforcement condition but not under the different alternating condition. When the reinforcement contingencies or tutoring context was changed, the patterns of social behaviors changed.

It is important to point out that the reinforcement contingencies and the social comments used in these studies were not extreme, yet some of the social behaviors that developed in these studies were very serious and required close attention. These results show that motivational factors were related to the development of the social/emotional behaviors. Therefore, academic programming should assure a high level of success and provide frequent feedback for that success to minimize the development of social adjustment problems.

SOCIAL REINFORCEMENTS

One purpose of this research was to determine whether social comments functioned as reinforcement when delivered on specific reinforcement schedules. The function of the social reinforcement can be analyzed in relation to the rates and patterns of responding of the children in the present experiments.

The data presented above on the rates of responding show that for many of the children the social comments functioned as reinforcements. Generally, there was an increase in the rates of the responses on which the social reinforcers were contingent. When social reinforcers were contingent on two different responses, correct responses in one condition and error responses in the second condition, there were differential increases in the correct and error response rates for the two conditions. When social reinforcers were contingent on one response, i.e., correct responses, but under two different intermittent schedule conditions, there were few differences in the correct response rates.

When social reinforcers were delivered after correct responses, there were higher rates of correct responses. When social reinforcers were delivered after error responses, there were higher rates of error responses. The relationship between the correct response rates and the social reinforcement contingencies remained for 3 children after a reversal of the tutors and the contingencies. This relationship was replicated for another child when new tutors employed the same contingencies as the previous tutors.

When social reinforcers were delivered following error responses, there were higher rates of error responses in the first phase. However, the relationship between error response rates and the reinforcement contingencies did not remain when the tutors and reinforcement contingencies were reversed.

The pattern data clearly show the effects of the social reinforcement. Both children in Experiment IV had greater conditional probabilities of long sequences of error responses under the schedule that delivered social reinforcers after sequences of error responses. This pattern of responding remained when the tutors and reinforcement contingencies were reversed.

For the comparisons between two different intermittent social reinforcement schedules, there were no consistent differences in the response rates. For the comparisons of an intermittent social reinforcement schedule and an extinction schedule, one child responded at a higher rate under the intermittent schedule but the other child did not.

Staats, Finley, Minke, and Wolf, 1964, reported that with token reinforcers there were no consistent differences in reading response rates for comparisons between two intermittent reinforcement schedules. For the comparison between an extinction schedule and an intermittent token reinforcement schedule, they reported that there were higher reading response rates under the intermittent schedule. The effects of token reinforcers have been shown on the amount of time that students spend on an academic task, Chadwick and Day (1971) and Felixbrod and O'Leary (1973), but these studies did not show an increase in the accuracy of the performance. The present studies controlled the amount of time that the students spent on a task and therefore did not show the effects of the social reinforcers.

In the present studies, the effects of the social reinforcers may have been reduced through the use of token reinforcement schedules as a control procedure. In most of the studies, the token reinforcement schedules were used to maintain the subject's participation in the tutoring sessions and to assure that the subject made academic progress.

The social reinforcement schedule was generally the experimental variable and was different for each reinforcement condition. Since the token reinforcement schedule was employed as a control procedure, it was kept the same for each reinforcement condition of the child. Thus, the effects of the different social reinforcement schedules were undoubtedly reduced. For example, with two children, social reinforcement after a correct response was compared with social reinforcement after an error response; but as a control procedure both tutors used the same token reinforcement schedule for correct responses.

Reinforcement Schedules

The rate data collected in these studies showed the effects of the social reinforcers but did not show the effects of the intermittent reinforcement schedule variables. However, the effects of the intermittent schedules can be seen through the patterns of differential responding on these schedules. Additionally, some of the social behaviors of the children may indicate the effects of the reinforcement schedules.

The cumulative records of child B2 in Experiment II, figure 0, showed that there were differences under the FR and FI schedules in the overall patterns of responding for the entire session and in the local patterns of responding. Under the FR schedule, the overall pattern for the entire session consisted of high rates of responding early in the session and pausing in responding later in the session. This pattern was previously discussed as possibly resulting from the child's history of earning only six tokens during the flashcard drill. Under the FR schedule, the local pattern consisted of high rates of responding. This local pattern of responding is similar to patterns described by Ferster and Skinner (1957) and may be attributed to the FR schedule.

The sequential recording techniques used in Experiment IV showed that the Tandum Brief-Stimulus schedule of reinforcement influenced the subjects' patterns of responding. The data showed that the subjects had increases in the probability of the occurrence of longer sequences of errors with the Tandem schedule.

Findley, 1962, pointed out that as individual responses interrelate to form patterns of responses; these patterns of responses can be used as a behavioral unit for a separate level of analysis. This second level of analysis can be accomplished reliably to the extent that the individual responses relate to form consistent and well-defined patterns.

In the present studies, the patterns of responding provided important behavioral units for analysis. Under the FR schedule with child B2, the unit of analysis was the cluster of responses that were followed by the delivery of the token reinforcer. A pause in responding occurred after the delivery of the reinforcer and in the latter third of each flashcard drill the pauses became longer. From the analysis of this behavioral unit it was suggested that the child's FR responding was influenced by the number of tokens that he had earned and that when he had obtained 5 or 6 tokens he stopped responding.

With the children in Experiment IV, the units of analysis were the lengths of sequences of consecutive error responses. The effects of the Tandem reinforcement schedule were shown consistently in the analysis of these data units for both children; yet the analysis of the rate data for correct and error responses did not show the effects of the reinforcement contingencies. The rate data summarize the whole session and there are many different performances which can result in the same summary data. The pattern data show the relationships between each response so that each performance is represented differently.

A few researchers have studied specific reinforcement schedules for academic responses, however, most of these studies have delivered the reinforcements at the end of each session after all the responses have occurred, Lovitt, Eaton, Kirkwood & Pelander, 1971; Lovitt,1975. The former study demonstrated that the children had different reading response rates for the different reinforcement schedules. That study showed that the different reinforcement schedules provided different motivational levels for the reading performances, but it did not show what patterns of responding developed on the different schedules.

The present studies used specific schedules of reinforcement for the responding as it occurred. The reinforcers were delivered immediately after the response specified by the reinforcement schedule. Although the reinforcers were delivered as the responses were occurring, only in the four cases described in the pattern section, were there data available for analyzing the interactions between the patterns of the child's responding and the delivery of the reinforcements. With each of these instances a different pattern of responding was demonstrated for the different reinforcement schedules.

Curriculum Programming

The rate data of the correct and error responses were used for the analysis of the effects of the social and token reinforcements. The accuracy ratio data were used for determining when the child should advance in the curriculum units. The child's progress through the curriculum units was monitored and controlled to reduce the effect of the changes in the curriculum material on the rate data for the children.

The average accuracy ratio for all stories in one curriculum unit was used for determining whether the child should be placed in the next curriculum unit. With this procedure, every child in the program had an increasing ratio for nearly all units. The curriculum criterion was based on the accuracy of the reading responding but all the children also had increasing accuracy ratios for the flashcard responding.

Table 7 shows the proportion of stories that a child read at criterion. For the children who participated in the research for more than one experimental term, there was an increase in the proportion of stories read at criterion in the second and third experimental term in 6 out of 8 comparisons.

Table 7. Proportion of Stories Read at Criterion

	Experimental Terms		
	1st	2nd	3rd
B1	.86	.94	1.0
B2	.56	.52	.81
B3	.60	.76	
B4	.60	.55	
B5	.96	1.0	
B6	.77	-	
G1	.82	.97	

Durkin, 1971, suggests that a reading curriculum is at the instructional level for a child if he can read that material at a 90% to 95% accuracy ratio. Gray, Baker, and Stancyk (1969) were able to maintain a child's performance level in the 90% to 94% range by making manipulations at the motivational level, and at the curriculum level. They found that at this performance level that the children made substantial gains in reading test scores.

Lovitt, 1975, notes that behavioral research with reading has not concentrated sufficiently on any specific behavior and, therefore, it is not possible to make conclusive statements about the instruction of specific skills. He points out that most of this research has studied the influence of some form of reinforcement on one of the various elements of reading. Lovitt feels that research should focus on the overall developmental stages for competent readers. He feels that developing a continuum of reading skills would greatly aid in reading instruction.

Although Lovitt's focus is on curriculum programming, he notes that for certain children the biggest instructional problem for the teacher is to discover a reinforcer. He suggests that the teaching process itself may be reorganized to provide more reinforcement to the student. By allowing the student to have more of the responsibility for the teaching/learning process and by allowing him to emit certain behaviors that the teacher traditionally emitted, learning may be more motivating. The student might select what is to be learned, the method of instruction, the criteria for progress, or the length of the study period. These self-management behaviors are often a neglected area of education for developing a responsible self-disciplined adult.

Future Research

This research showed the effects of the reinforcement contingencies on the rates of correct and error responses, on the patterns of the reading responses, and through the social/emotional behaviors of some of the children. From these findings new research questions can be addressed; however, a main contribution of this research has been the application of techniques for studying the patterns of the academic responses. These techniques can be used in answering other research questions or for diagnostic purposes with individual children in the classroom.

Behavioral Contracting

As Lovitt, 1975, indicated, motivating the student may be the biggest obstacle in teaching the student. Behavioral contracting, Homme, 1970, has been used to motivate the student by giving him a role in deciding the academic behavioral pin-point and the reinforcement contingency. Behavioral contracting has been investigated for its effectiveness in enhancing academic performance. With cumulative records and probability distributions, behavioral contracting can be investigated for its effects on the patterns of academic performance. Initially, comparisons could be made between the patterns of responding that develop when a reinforcement schedule is imposed on the child without a description of the reinforcement contingencies, and when a similar reinforcement schedule is contracted with the child with the reinforcement contingencies discussed.

Weiner (1970) told adult subjects how many reinforcements they could earn for lever responses. After a short period of FR 10 conditioning, the subjects were exposed to an extinction condition. Subjects that had been accurately informed as to the number of reinforcements they could earn emitted few extinction responses. More extinction responses were emitted by subjects who were informed that they could earn a greater number of reinforcements. However, the greatest number of extinction responses were emitted by subjects who were given no prior instructions as to how many reinforcements they might expect. The contracting can be expanded to include several behavioral pinpoints within one curriculum area or to include behavioral pinpoints from several curricula areas.

Choice Behaviors for Academic Curricula

Behavioral contracting can be expanded to include several pinpoints from the same or different curriculum areas. When several behavioral pinpoints and their reinforcement contingencies have been established, the child can be given some choices as to when he will perform the pinpointed behaviors. The child's choices for several concurrently available reading programs could be examined in relation to differences in the reading materials and reinforcement schedules. Choice responding could be compared between one reading program that provided much reinforcement for more difficult material and a reading program that provided less reinforcement for easier materials.

Research has been done with animals to analyze when they will choose to change from one reinforcement schedule to a concurrent reinforcement schedule, Catania 1966. These choice responses, i.e., changeover responses, generally occur after the delivery of reinforcement on the schedule. When there is a great disparity in the frequency of reinforcement on two schedules, the animal subjects spend most of their time responding on the more favorable schedule. Jacobson, Bushell, and Risley (1969) established requirements for children to change activities in a Head Start program. The children's changing from one activity to another was manipulated by varying the difficulty or magnitude of the change-over task.

In research on the academic responding of children, contingencies could be applied to the choice responses that specify when a choice response could be made. The choice behavior could be made contingent upon the academic responding, e.g., the child may have to get at least 25 flashcards correct before he could change to the reading program. The choice behavior could be independent of the reading responses, e.g., the child can change the academic program whenever he wants but he can only make 4 changes within the 45 minute reading period. The effects of these contingencies could be examined through the patterns and rates of the choice behaviors and the reading responses.

In the present research, the performance of child B2 provided an example of a situation in which behavioral contracting might have facilitated the child's academic performance. On several occasions child B2 chose not to do the writing exercises and on several other occasions not to do the flashcard drills. Since no alternative choices were available, the child sat and did nothing or he returned to his classroom. Choices were not provided because the child's performance on the reinforcement schedules was not considered stable and so the conditions were studied longer.

Correct and Error Responses

Another area of research that can be pursued from these studies is the differences found between reinforcing correct responses and error responses. The effects of the reinforcement contingencies reversed for the correct responses but did not reverse for the error responses when the reinforcement contingencies and tutors were reversed. Disapproving comments for error responses increased the accuracy of the reading performance for one child but decreased the accuracy of a second child. This second child had an extreme stress reaction to the disapproving comments.

From the achievement point of view, it appears that reinforcing correct responses and ignoring error responses is a good strategy. However, most people are not so benevolent and place more emphasis on correcting mistakes. Much of education teaches the students around the errors that he has made. Many families feel that guidance is provided to children through the punishment of mistakes.

As Spence and Segner (1967) point out, the most information is provided to the subject when he is provided feedback for both his correct and effor responses. However, the present research has shown that positive feedback after error responses increases the errors and that negative feedback after error responses precipitated a stress reaction in one child. A procedure that simply provides the correction to the error response may avoid the effects of the positive and negative feedback.

Summary

This chapter has organized the results of the four experiments and has shown that the social reinforcement schedules have had consistent effects on the reading behaviors of the children. The rate data showed the effects of the social reinforcers delivered after correct or error responses. The rate data did not show the effects of the intermittent social reinforcement schedules, however, the pattern data showed the effects of the reinforcement schedules with three children. The occurrences of significant social behaviors were related to the reinforcement contingencies on the academic exercises.

A goal of this research was to determine whether the techniques of a behavioral analysis, Sidman 1960, could be utilized with the reading behaviors of children. The findings of this research show that this goal has been realized.

Future research was suggested that would compare the performance of a child first under a condition in which certain unannounced academic and reinforcement contingencies were imposed on the child. Next, behavioral contracting could be done with the child giving him a role in determining the conditions and comparing this performance with the performances under the previous two conditions. A final set of conditions could give the child some choice responses so that the child could change the conditions during each session. This future research could study the patterns of the child's responding so that we can learn more about how a child's responding interacts with his environment.

GLOSSARY

The following list of terms and their definitions is provided for the reader in order that he might fully understand the phraseology used in this work.

Accuracy Ratio: Measure of accuracy: $\frac{\text{Rate Correct}}{\text{Rate Error}}$ (see Graph Key).

Baseline: A stable performance prior to the introduction of treatment upon which the effects of experimental variables can be assessed.

Behavioral Contrast or Contrast Effect: A change in the rate of one response accompanied by an inverse change in the rate of a second response.

Behavior Ceiling: The highest daily behavior rate possible for a particular behavior.

Behavior Floor: The lowest daily behavior rate possible for a particular behavior.

Celeration: Basic unit of measurement of behavior change. Change in rate per unit of time; responses per minute per week (see Graph Key).

Chain Schedule: A compound schedule in which reinforcement depends on the successive completion, in a particular order, of the requirements of two or more component schedules, each of which operates in the presence of a different stimulus.

Concurrent Schedule: Two or more schedules which operate simultaneously and independently, each for a different response.

Conditional Probability: The probability of one event given that some other event has occurred.

Conditioned Reinforcer: A stimulus that has become effective as a reinforcer because it has consistently preceded another primary reinforcer.

Conjoint Schedule: Two or more component schedules, usually involving different reinforcers, operating for a single response.

Continuous Reinforcement Schedule (CRF): Reinforcement of every response of a target behavior.

Contingency: The conditions under which a response is followed by the reinforcing stimuli. Noncontingent: The reinforcing stimuli are presented without a relationship with the response.

Glossary - Continued

Cumulative Record: A graphic record in which total responses are plotted as a function of time. In a cumulative record a recording pen moves along the abscissa with the passage to time and along the ordinate each time a response occurs. Thus, the rate of the response is demonstrated by the slope of the curve. The moment-to-moment changes in slope provide a detailed picture of the way in which the rate of responding changes over time. It takes approximately 46 responses to move the record up 1 centimeter.

Discriminative Stimulus: Any stimulus having a discriminative function in the control of behavior.

Extinction (EXT): A schedule of nonreinforcement.

Fixed-Interval Schedule (FI): Reinforcement is delivered following the first response emitted after a fixed time has elapsed since the last scheduled reinforcement.

Fixed-Ratio Schedule (FR): Reinforcement is delivered after a fixed number of responses have been emitted since the preceding reinforcement.

Geometric Mean: The appropriate method for obtaining an average on a ratio scale. The n^{th} root of the product of an n number of data points multiplied together (see Graph Key).

Mixed Schedule: A compound schedule in which two or more component schedules operate in alternation, all in the presence of the same stimulus.

Multiple Schedule: A compound schedule in which reinforcement is programmed by two or more schedules alternating; each schedule being accompanied by a different stimulus as long as the schedule is in effect.

Pattern of Behavior: When a group of responses have a temporal or sequential relationship. Patterns are repeated and are generally related to the reinforcement contingency.

Quarter-Intersect Method: To draw celeration line on graph: (1) divide time interval on graph into four equal quarters, (2) find median rate of each half, (3) draw line through the first and third quarter lines where the median rates cross them.

Rate: Responses per unit of time. Specifically, movements per minute; the measure found on the Standard Behavior Chart. The basic unit of behavioral measurement.

Schedule Control: When a pattern of performance develops that is related to the particular reinforcement schedule in effect.

Glossary - Continued

Schedule of Reinforcement: A specification of the way in which reinforcements are assigned to the particular response class.

Standard Behavior Chart: A six-cycle logarithmic chart designed for the graphic display of ratio data such as rate (see Graph Key).

Tandum Brief-Stimulus: A compound schedule in which reinforcement depends on the completion in succession of the requirements of two or more component schedules, all in the presence of the same stimulus. A brief stimulus is associated with the completion of the component schedules.

Target Behavior: The class of responses that have the contingency relation to the reinforcement.

Timeout Procedure: A period of non-reinforcement arranged by the removal of an opportunity to respond (e.g., the reading material is removed from in front of student so that he can't emit a reinforceable response).

Token Reinforcement: A conditioned reinforcer that the organism may accumulate and later exchange for other reinforcers.

Variable-Interval Schedule (VI): The same as FI except that the time from a reinforcement to the availability of the next reinforcement is variable.

Variable-Ratio Schedule (VR): The same as FR except that the number of responses required for each reinforcement is variable, not fixed.

APPENDIX A
DAILY DATA SHEET

Schedule

Date ________ Phonics ______

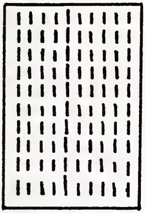
Child__________________

Tutor__________________

Story__________________

1. Social Reinforcement
2. Positive Comments
3. Negative Comments
4. Complaints
5. ______________
6. ______________

Flash__________	Error	Reading______	Error	Writing______	Error
Time__________		Time ________		Time ________	
Correct________		Correct______		Correct______	
1. ____________	4.______	1. ______	4. ______	1. _____	4. _____
2. ____________	5.______	2. ______	5. ______	2. _____	5. _____
3. ____________	6.______	3. ______	6. ______	3. _____	6. _____



APPENDIX B
POINT SHEET

APPENDIX C
SOCIAL REINFORCEMENT COMMENTS

Standard Social Reinforcement

- Good
- You're doing fine
- That's right
- Okay
- You're doing good

High Intensity Social Reinforcement

- Three in a row right
- What a good reader
- Yeah, you got it
- That's a girl (boy)
- Hurray

Standard Social Reinforcement after Error Response

- That was close
- Almost
- These are hard
- Maybe next time
- There's another hard one
- Better luck next time

Disapproving Comment after Error Response

- You missed it
- Try harder
- I just told you that one
- Try remembering
- Don't miss it again

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BIOGRAPHICAL SKETCH

James W. Taylor was born in Washington, D.C. in 1947. He grew up in Southeast Washington with his mother and brother. In 1965, he graduated from Anacostia High School and moved to Gainesville, Florida. Jim received his Bachelor of Arts degree in Mathematics in June, 1969, from the University of Florida. He transferred to Psychology for Graduate School, to study Clinical Psychology, Child Development, and the Experimental Analysis of Behavior. He received his Master of Science degree in Psychology in June, 1971. During the 1971-72 academic year, Jim was a Departmental Instructor for the Psychology of the Exceptional Child. He was selected as a Graduate School Fellow the following year, 1972-73. During this two year period, Jim developed a remedial reading tutoring center at Kirby-Smith Elementary School, which was the setting for his dissertation research.

Jim returned to the Washington, D.C., area in August, 1973, to begin his internship with the Montgomery County, Maryland, public schools. In November, 1974, he started his current job as the Director of Early Identification and Consultative Childrens Program at Hamilton Children's Center in Hyattsville, Maryland. Jim has been working at the center for four years with young children and their families.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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